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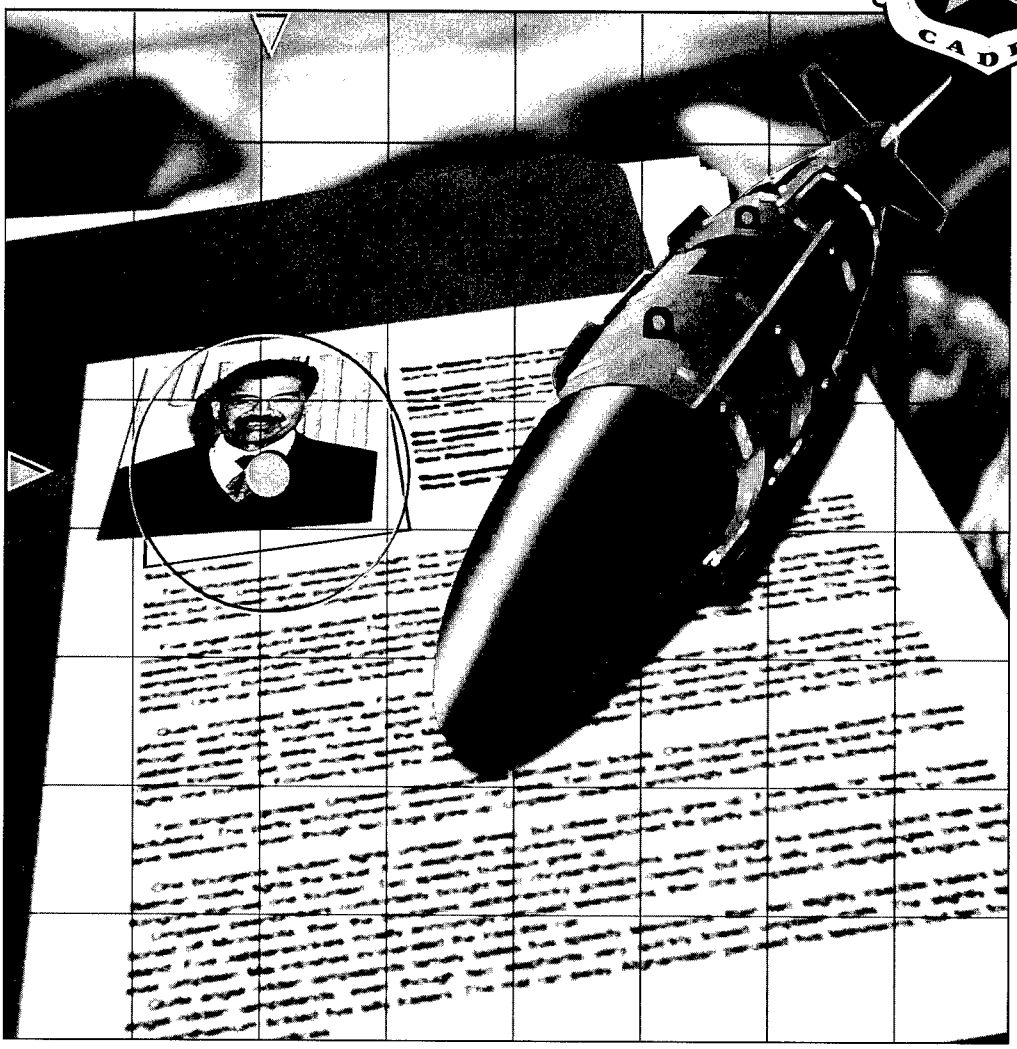

Thinking Effects

Effects–Based Methodology for Joint Operations

Col Edward C. Mann III, USAF, Retired
Lt Col Gary Endersby, USAF, Retired
Thomas R. Searle, Research Fellow

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Thinking Effects

Mann, Endersby, & Searle

Effects-Based Methodology for Joint Operations

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Thinking Effects

Effects-Based Methodology for Joint Operations

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Contents

	Page
DISCLAIMER	*ii*
FOREWORD	*vii*
ABOUT THE AUTHORS	*ix*
ACKNOWLEDGMENTS	*xi*
INTRODUCTION	1
TIME FOR A NEW PARADIGM?	4
HISTORICAL BACKGROUND ON EFFECTS	17
CONCEPTUAL BASIS FOR EFFECTS	29
A GENERAL THEORY OF JOINT EFFECTS-BASED OPERATIONS	42
AN IDEALIZED JOINT EBO PROCESS	55
WHAT ARE THE MAJOR CHALLENGES IN IMPLEMENTING THE EBO METHODOLOGY?	77
CONCLUSIONS	87
NOTES	88
TERMS AND DEFINITIONS	95

Illustrations

Figure		
1	The Dual Nature of Effects	30
2	Example of First/Second/Third Order Effects	32
3	Complexity of Higher Order Effects	33
4	Fundamental Relationships of Various Effects	40

Figure *Page*

5 Relationships between Objectives and Strategies 46

6 Objectives-Based Methodology 47

7 The Effects-Based Methodology 49

8 Relationships between Indirect Effects and Objectives 52

9 Effects-Based-Planning Process Model 56

10 Detail of National-Level Process 69

11 Joint Campaign-Level Process Cycle 74

Table

1 Relationship of Objectives, Effects, and Targets 35

Foreword

The United States has a reputation for having the strongest military force in the world—perhaps even the best in history. Still we continue to struggle with force application in an era without the monolithic Soviet enemy. Our doctrine, written in a paradigm seeking "total victory," has been refined through World War II, Korea, Vietnam, and the Persian Gulf War. It has been assiduously adapted for major theater warfare and what can be called the conquest paradigm. We need to change. We need to adapt to a different world of continuing struggle between and within nation-states, one where military strength and political persuasion are applied with smarter flexibility.

In *Thinking Effects: Effects-Based Methodology for Joint Operations*, Col Edward C. Mann III, USAF, retired, Lt Col Gary Endersby, USAF, retired, and Thomas R. Searle propose that military actions should be employed through effects-based operations (EBO). These authors have developed an extended explanation of EBO methodology earlier defined in an Air Combat Command white paper, "Effects-Based Operations." Challenged by the white paper to define procedures in the EBO methodology, they further codified the EBO way of thinking. Submitting that this methodology is extremely promising, they recognize two major areas of challenge. First, is modifying both service and joint doctrine to fully articulate what can be accomplished with EBO. Second, there are major issues in the area of command and control (C^2). Effective C^2 for EBO depends on how intelligence analysis and combat assessment not only are performed but also integrated into the planning process.

The College of Aerospace Doctrine, Research and Education (CADRE) is pleased to publish this study as a CADRE Paper and thereby make it available to a wider audience within the US Air Force and beyond.

DANIEL R. MORTENSEN
Chief of Research
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Introduction

A notable shift in geopolitics began more than 10 years ago with the collapse of the Soviet Union. From the perspective of the US military, the primary thrust of this shift was to replace a unitary, implacable, and constantly threatening foe—world communism, represented by the Soviet Union, China and their allies—with more nebulous and multifarious threats. Combined with the experience of World War II, this long-enduring face-off contributed to the development of a conquest paradigm in US military doctrine. Despite the experiences in Korea, Vietnam, and other places over the ensuing decades, the majority of doctrine was written to deal specifically with a major theater war (MTW) through the employment of the conquest paradigm.

While the cold war brought relative clarity and stability to US military and foreign policy, the twenty-first century has displayed a decidedly changed geopolitical climate. The US military is undergoing a transformation to be prepared for operations across the spectrum of engagement. Consequently, this study proposes that part of the transformation should deal with how the military thinks and operates. In this manner, military actions should be employed through effects-based operations (EBO), originally outlined in the May 2002 Air Combat Command (ACC) white paper on EBO. Both the ACC white paper and this study stress that EBO is not focused on conquest or necessarily even warfare as traditionally defined. Essentially, EBO represents those actions taken against enemy systems designed to achieve specific effects that contribute directly to desired military and political outcomes. In a general sense, US forces have always had certain desired effects in mind when conducting military operations. However, they often pursued military objectives without direct reference to appropriate effects that would create the conditions for achieving them and with little consideration of other effects that were created along the way. The EBO methodology is designed specifically to address these areas as well as provide a better environment to assess the results of military actions.

EBO needs to be understood in the context of what it really is and is not. EBO is not a new form of war fighting nor does it displace any of the currently recognized forms of warfare. Attrition, annihilation, coercion, maneuver, and all other such warfare concepts are unaffected by EBO. For consistent, sustained success, there must be a comprehensive, shared vision of what EBO is and how it works. The study seeks to elaborate on the following three specific areas:

- a fully developed theory grounded in effects-based thinking;
- a process to facilitate development of an organizational culture of EBO processes; and
- a lexicon that promotes understanding through a common language.

To realize all that EBO offers, it must be incorporated into military planning and operations. The EBO methodology is simply a methodology for planning, executing, and assessing operations designed to attain the effects required to achieve desired national security outcomes. The EBO methodology is actually a refinement or evolution of the objectives-based planning currently incorporated in US military doctrine. The objectives-based methodology utilizes a strategy-to-task approach for planning military operations. An EBO methodology takes this process a step further by allowing planners and commanders to examine conditions and causal linkages through which actions lead to objectives. Causal linkages, perhaps the most critical element of the methodology, explain why planners believe the proposed actions will create the desired effects.

The EBO methodology is much broader than solely military applications. It incorporates all the elements of national power—diplomatic, economic, military, and information—for a particular situation and is applicable across the full spectrum of activities from peace through global war. As with the objectives-based approach, EBO requires military commanders to explicitly and comprehensively link—to the greatest extent possible—strategic and operational objectives to each tactical action.

A proposed idealized planning model will enhance effects-based thinking before, during, and after operations. The process is both continuous and iterative and contains five phases: strategic environment research, determine policy goals, developing a strategy, mission parsing and integration, and effects assessment. First, strategic environment research attempts to gather relevant information regarding potential adversaries. Such background information may indicate potential centers of gravity (COG) and answer a number of broad-ranging questions. For example: What type of effects would be most appropriate in the given set of circumstances? How might these effects be achieved, and what kind of indicators would determine the nature and extent of the effects? Second, to determine policy goals include a statement of the intended effects and outcomes that will lead to achieving those goals. Third, developing a strategy is to employ the vast range of resources available to achieve desired effects. Fourth, the mission parsing and integration phase determines the elements of national power best suited for each task and how all the elements will work together to achieve the policy goals. This phase defines the mission for combatant and/or joint force commanders (JFC). Fifth, this phase is effects assessment, wherein information provided through intelligence collection and other sources is used to determine whether policy goals are being achieved and what needs to be done next. This series of phases requires interagency discussion and decisions by the president or the secretary of defense. The military needs to participate proactively in these deliberations and research. Although the military does not control this particular aspect of the process, it can benefit from fully articulating a clearly defined effects-based process such as this one, even though it might not be precisely implemented.

In summary, EBO represents actions designed to achieve specific effects and can be incorporated into a methodology for planning, executing, and assessing operations required to attain desired national security outcomes. This methodology is extremely promising, but at the same time it presents major challenges. To be fully successful it requires the development and understanding of a comprehensive EBO theory and asso-

ciated lexicon. The methodology itself will require changes to processes and procedures within the joint/interagency arena that have been in place for some time. The EBO methodology should be viewed as an expansion of the current objectives-based process, which offers significant benefits for meeting the challenges and exploiting the opportunities in the twenty-first century.

Time for a New Paradigm?

Going into the second decade of the post-cold-war era, the US military establishment is still struggling with the altered geopolitics and the role it is asked to play in the new world order. The military leadership, though trying hard, cannot seem to shake the legacy of World War II and its aftermath. It is struggling with new understandings, but much of the conceptual thinking and development is stuck in an old paradigm that the authors call the conquest paradigm. This paradigm, which may or may not have ever been appropriate, certainly does not apply now. When Gen Douglas MacArthur said "there is no substitute for victory," he was not merely stating a sentiment that many US military leaders adhered to throughout the twentieth century but also voiced a central tenet of the conquest paradigm. This tenet, expressed in many ways over the years since Korea and Vietnam, holds that use of the military should be a last resort when diplomacy and politics have failed. At this point statesmen and politicians should turn the problem over to the military and afford the armed forces freedom of action. The military would then employ the required force to reduce to ashes the adversary's ability and will to resist, thereby achieving total victory as measured by the complete defeat of enemy forces and the unconditional surrender of the enemy's military and political leaders. That task completed, the military would then relinquish control back to its civilian masters.

That paradigm, however, fits only a narrow range of today's tasks and challenges. Our nation's armed forces need to move to a new paradigm; one based not on conquest, which is almost never the goal today, but on achieving success across the

entire spectrum of engagement whether, political, military, humanitarian, or some combination thereof.[1] Perhaps it can be called the success paradigm. While *Joint Vision 2020* (*JV 2020*) moves US military thinking several steps closer to such a paradigm, the military services, acting jointly, need to take at least one remaining step: define an overarching implementation concept for *JV 2020*. This construct will focus the four operational concepts of *JV 2020*—dominant maneuver, precision engagement, focused logistics, and full-dimensional protection—on effects the military can create to produce the vision of full-spectrum dominance articulated by chairman of the Joint Chiefs of Staff (CJCS).

Each service and the joint staff have taken halting steps in the direction of EBO by experimenting with, or discussing, at least some aspects of EBO. The USAF has studied "effects-based targeting" for many years but, to date, has not codified the concept in any formal sense. The joint services do not share a commonly agreed lexicon of effects-based terminology. Such terms are commonly used as if they had clear definitions, but they do not. This study proposes correctives to incorporate EBO in USAF and joint doctrine through an effects-based lexicon, theory, and process.

The path to implementing the EBO concept and a corresponding EBO methodology along with comprehensive effects-based thinking for military actions will not be easy to traverse. Such a shift in operational concepts will not guarantee success, nor will these concepts clear the normal fog and friction of war. An EBO methodology will provide a systematic approach to planning, executing, and assessing results of military actions across the entire spectrum of engagement ranging from peacetime to global war and back to peacetime. It will assist military planners to focus on output not input, and on national goals rather than the capabilities and prerequisites of the services, singly or collectively.[2] This shift in thinking cannot help but make the US military better and more prudent guardians of the nation's peace and prosperity. This study does not provide final answers, but it does start the process of bringing together the conceptual debate that will move the US

military establishment firmly from the old paradigm to a new, more appropriate one.

The USAF has embarked upon a path to prepare for military action in the current and future geopolitical environment. *America's Air Force: Air Force Vision 2020—Global Vigilance, Reach, and Power* outlines the reorganization to an expeditionary air and space force, the movement to integrate the air operations center (AOC) as a weapon system, and the Force Development—formerly the Developing Aerospace Leaders—program, which is further explained later in this study. These actions are aimed at developing a more agile, more capable, and more relevant Air Force. With an eye towards the future, an EBO methodology may be the final piece the Air Force needs to fully implement *AF 2020* and *JV 2020.*[3]

The Imperative to Change Now

The cold war brought relative clarity and stability to US military and foreign policy. Throughout the cold war the main foreign policy goals of the United States were to contain the spread of international communism and limit the influence of the Soviet Union and, to a lesser extent, Communist China. The Soviet Union had extremely capable armed forces; and Soviet leaders were explicit and outspoken in their intention to weaken and, if possible, destroy the United States. When Soviet premier Nikita Khrushchev angrily told the United States, "we will bury you," he meant it; and though he and subsequent Soviet leaders failed to do so, it was not for lack of trying. The Soviets posed an enormous threat to the United States, perhaps the greatest threat the nation has ever faced. That threat was not only immense and imminent but also clear and remarkably persistent. Against this backdrop, the process of organizing, training, and equipping forces to meet the threat was fairly straightforward. It was also fairly simple to see who would be likely allies in the effort to contain communism. This clarity and stability extended to the entire interagency process.

The end of the cold war, following collapse of world communism and subsequent disappearance of the threat from the Soviet Union and its Warsaw Pact allies, changed everything. The

United States no longer faced an obvious threat to its very existence, and many former adversaries became friends. Several former Warsaw Pact foes have since joined the North Atlantic Treaty Organization and become formal allies of the United States. From a global perspective, the end of the cold war conflict left the world with several local and regional conflicts, some new, some old, and each quite different from the others. The threats in the post-cold-war world are numerous; but they are much less clear, persistent, and predictable than was the Soviet threat.

The Korean War and Vietnam War were fought in the context of this global cold war. The communist governments in Beijing and Moscow actively supported foes of US allies in Korea and Vietnam. Communist China and the Soviet Union hoped to use these wars to expand world communism, while the United States fought in both places to contain international communism. In contrast, Operations Just Cause in Panama and Desert Storm in the Middle East were not part of any global conflict but were regional conflicts.[4] More surprisingly, the foes in these actions—Manuel Noriega's Panama and Saddam Hussein's Iraq—had not always been "enemies" of the United States. In fact each had received significant assistance from the United States prior to events that led to the interventions. Both cases represent the more transient nature of international relationships in the new geopolitics.

The New Environment

The cold war world was a black-and-white world in which the United States had a clear understanding—from year to year—of who were its foes and friends, with a relatively small number of states falling into the gray area between these two poles. The US military knew without question who the potential enemies were and war fighters studied Soviet and Warsaw Pact doctrine, equipment, tactics, techniques, and procedures. Year after year, planners could simply revise plans to deal with a massive Soviet invasion through the Fulda Gap in Germany or through Iran into the Middle East. Today they face a much grayer world with no clear-cut enemies and a handful of "states of concern." In Noriega's Panama, enemy doctrine and

equipment were largely similar to those of the invading US forces because President Noriega and many members of the Panamanian military had attended US military schools, and had bought a lot of US military equipment.[5] Similarly in the Persian Gulf War, Iraqi foes and coalition friends were often armed with the same equipment and had been trained according to several different doctrines, sometimes similar, sometimes not. In contrast to the good old days, a single friend-or-foe equipment quiz for the entire force would now be unfeasible, since friends and foes can change dramatically from scenario to scenario. Instead the military will need to tailor and conduct such training based on the contingency at hand and the specific allies and foes involved. The notion of universal, worldwide threat doctrine is clearly outdated.

In this changed climate, military actions will be radically more complicated. US forces may have to respond with little advance warning and little beforehand knowledge of who the enemy is. They may need to switch rapidly between humanitarian relief operations (HUMRO), peacekeeping, and fierce combat. In Panama, in late 1989 and early 1990, Operation Just Cause began with a few days of combat but quickly transitioned to nation building. In Haiti in 1994, the United States prepared to depose a government by force of arms but wound up doing so without firing a shot. The force assembled to overwhelm the Haitian military immediately had to redirect its efforts to rebuilding a nation that had suffered neither war nor natural disaster but simply decades of extremely bad government. During 1993 in Somalia, the transition went the other way when a force sent to perform a HUMRO found itself in combat against some of the very people they were originally trying to assist.

Recently US military forces have been involved around the world, helping people recover from natural and man-made disasters, acts of terrorism, and from armed conflicts. These forces have been trying simultaneously to keep the peace in places as diverse as the Sinai desert and the mountainous jungles on the border between Peru and Ecuador. In all these situations, US forces are making the world a better place and contributing to US national security; but often terms such as

enemy, *victory*, and certainly *conquest* are not appropriate. In fact, many familiar old cold war concepts are detrimental to US national goals in this new environment. US forces need to develop concepts of military action to meet the challenges and exploit the opportunities presented by the current geopolitical environment.

Perhaps one of the most striking changes in the geopolitical environment is the fact that in this new era one cannot assume that future conflicts will typically be between nation-states. At the same time that globalization and new technologies are bringing unprecedented prosperity to people around the world, they are also facilitating transnational threats to national security. These new threats include such groups as drug cartels and international criminal and terrorist organizations. Operation Enduring Freedom has shown that combating the terrorist threat, in particular, requires unprecedented levels of interservice, interagency, and international coordination, as well as highly sophisticated understanding of the direct, indirect, intended, and unintended consequences of all actions taken. Additionally, the United States has learned through bitter experience that cracking down on drug production or money laundering in one country encourages the spread of these activities to other countries. In the past the United States has not always adequately anticipated these responses, and the effectiveness of operations has been compromised by the inability to prevent drug production moving to new areas and new money laundering operations from replacing old ones.

Humanitarian crises are another challenge encountered more often in this new era. As prosperity increases around the world, the international community and the US public have developed a growing intolerance for human suffering and national instability, sometimes in areas of little or no strategic interest. The US military finds itself increasingly involved in mitigating natural and man-made humanitarian disasters around the world. This trend will likely continue, and the United States will need to improve its ability to conduct these kinds of actions. Sometimes they will involve combat, such as Operation Allied Force in 1999, and in other instances, action will

be purely noncombat, as in flood relief efforts in Mozambique. The success of these actions requires a seamless melding of capabilities into a joint, interagency, and international effort that mitigates the immediate humanitarian crisis, creates the basis for a sustainable long-term recovery, and improves living conditions. Traditionally the US military has been among the first on the scene of a crisis and has emphasized addressing the immediate problem. This is important, but the joint forces need to meet initial objectives for crisis response and then work in concert with other appropriate agencies for a smooth transition to normality.

A Revolution in Military Affairs?

Geopolitics is not the only thing that has been changing. Since the end of the cold war expanded application of rapidly developing technologies (particularly information technologies), combined with new business practices and organizational concepts, have enabled commercial firms to radically transform the way they do business. The end of the cold war and this expanding use of information technologies have promoted the globalization of economic activity. Economic and commercial globalization promise to make both the internal and external mechanisms of national economies more efficient, more prosperous, and more integrated than they were previously. These changes have contributed enormously to the new challenges and opportunities faced by the United States and its military. Many of these developments have served as force multipliers but also present new and different kinds of vulnerabilities. On the one hand, networked information systems have increased efficiency and effectiveness in organizations that have embraced them. At the same time these technologies have increased their user's vulnerability to destructive "cyber attacks" of types that were pure science fiction a few short years ago. US forces have taken advantage of some originally commercial concepts, such as just-in-time delivery, and are in the process of embracing information operations. However, the implications of these changes have not yet fully worked their way into institutional thinking.

For example, no one is sure how all these changes affect traditional military actions. Economic globalization would seem to make such traditional military actions as blockades dramatically more effective than in the past because nation-states are more dependent than ever on trade with other countries. The increased importance of international trade means that the unintended collateral effects of an embargo against a target nation are more difficult to understand fully. Its trading partners will also be more severely impacted than in the past. Who will be damaged more by a blockade: the target nation or its trading partners, some or all of whom the blockading countries may not intend to harm? Similarly, traditional strategic attacks on weapons manufacturing plants and industrial targets may be less effective than in the past if the equipment destroyed and any production lost can be quickly and easily replaced in the international marketplace. Additionally, now that capital flows are more global than ever before, it may prove that an industrial facility in a hostile country is owned either by a friendly country or a US-based firm. Deciding whether or how to attack such facilities requires much more sophisticated coordination and forecasting of collateral, indirect, and unintended consequences than anything faced in planning attacks on the Soviet Union during the cold war.

Fortunately, the technologies that succeeded so spectacularly in Operation Desert Storm and the new technologies that have been emerging since may offer the tools to increase effectiveness in this new global environment. As more accurate and comprehensive real-time information about the world is available, military planners and operators can—with increased precision—tailor activities to the evolving situation. Given the increased availability of precision tools such as airborne lasers, small smart bombs, concentrated air-deliverable humanitarian rations, and similar devices, US forces will be able to achieve even more exact physical effects. These technologies will dramatically expand military capabilities. To benefit fully, planners and operators must avoid the trap of simply using new tools to do the same old things in better ways. Instead they must take a fresh look at everything to determine what exactly they are trying to achieve and whether, in light of

these new capabilities, they can achieve assigned policy goals more effectively by using new methods and organizational schemes.

The US military has undertaken several major initiatives to help harness new and emerging capabilities to meet the challenges of the post-cold-war world. The Air Force, for instance, established the Air Force Doctrine Center (AFDC) at Langley AFB, Virginia, in 1995 (moved to Maxwell AFB, Alabama, in 1997) to help the Air Force as a whole think clearly about doctrine and speak with one voice. AFDC strengthened the USAF doctrine development process, clarified and improved air and space doctrine, and helped strengthen the entire training and education program. Incorporating doctrine more thoroughly in educational programs has improved USAF schools across the board, is steadily improving the level of professional knowledge throughout the force, and has—in turn—enhanced the USAF's contributions to the joint and interagency team.

The second major change in the Air Force has been adoption of the concept of the expeditionary air and space force and its embodiment in air and space expeditionary forces. The Air Force has embraced the expeditionary concept, recognizing that in the future it will be increasingly required to react quickly to crises in areas where there are no forward deployed US forces or developed bases. Air and space expeditionary forces dramatically improve the USAF's ability to operate on short notice from austere bases. As Air Force people continue to refine and practice expeditionary operations, the capacity to conduct such missions will continue to mature.

Most recently the USAF began a third major program focusing on the issues discussed in this study. This initiative titled Force Development—formerly Developing Aerospace Leaders—takes a hard look at the way the Air Force selects, trains, educates, and assigns leaders. The goal is to cultivate the sort of imaginative, widely knowledgeable, flexible, and sophisticated leadership needed for the future. Still in its early stages, the Force Development program builds on the doctrine, education, and expeditionary initiatives already under way. Force Development promises to transform the Air Force even more pro-

foundly than earlier educational initiatives and to provide the very type of leadership necessary to conduct EBO.

The rest of the joint community has been working similar issues. The US Navy has changed its focus from control of the seas to projecting power ashore. The Marine Corps has shifted from its previous doctrine of avoiding cities whenever possible toward solving the problems of urban warfare. The US Army is proposing a radical transformation of its force structure away from heavy armored forces toward much lighter, more strategically agile expeditionary forces. These are just a few representative examples of what the services are doing to prepare for twenty-first century military action.

In addition to the initiatives within the individual services, the JCS have developed a new joint vision for the future. As mentioned previously, *JV 2020* lays out a broad vision of how the military intends to achieve the nation's goals in full partnership with the other members of the interagency team and coalition partners. Central to that vision is achieving full spectrum dominance, which will enable US forces "to defeat any adversary and control any situation across the full range of military operations."[6] The Air Force intends to achieve full spectrum dominance by incorporating information superiority and technological innovation—the key enablers—into all activities, and capitalizing on the four operational concepts of *JV 2020:* dominant maneuver, precision engagement, focused logistics, and full dimensional protection.[7] Full spectrum dominance along with the key enablers and operational concepts were originally spelled out in *JV 2010,* which was published in 1996. The services have progressed in these areas. Nevertheless, a transition to a joint effects-based operations approach would enable the United States to realize the potential set forth in *JV 2020.*

The Continuing Need to Revise Military Thinking

This study proposes a theory of military action that considers the full spectrum of engagement, including MTW, but not focused on conquest, or necessarily even warfare as traditionally defined. To gain the full benefit of this concept, approaches to organizing, training, and equipping for military actions

must change. Most importantly, the thought processes used to think through contingencies of all types must also change.

Most current military doctrine is rooted in the concept of military action that the authors call the conquest paradigm. In this theoretical framework, military actions are not viewed as an extension of politics and diplomacy but rather the end, or more specifically, the failure of politics and diplomacy. Such actions are total wars fought by any and all means until victory is achieved. The chief model of the modern era was World War II, which resulted in total victory of the Allies over Axis forces. The means available in these total wars are limited by the laws of physics and national budgets, or more correctly, resources, and not much else. Under this paradigm, any target that makes sense militarily can and should be attacked and destroyed. In traditional theory, the ultimate goal of ground action normally is the enemy capital, which armies reach through the intermediate goal of destroying the capability and will of the enemy's military forces to resist. Conquest results in total peace. Once the war is over, the politicians and diplomats reclaim their prewar leadership roles while the armed forces demobilize and resume peacetime training.

The conquest paradigm is rigorously fight-centric and almost obsessed with the big fight, wherein the armed forces concentrate on physically destroying opposing military forces. They also identify, target, and destroy infrastructure that supports the ability of the enemy's military to sustain opposition. Achieving both goals is the main, and perhaps only, important measure of effectiveness. This paradigm is often actively hostile to "unnecessary" (read any) political restraints on the use of military force and to politically motivated actions. It acknowledges but has little tolerance for military operations other than war (MOOTW). The conquest paradigm assumes relatively clear and abrupt transitions between war and peace, and employs terms like *desired end state*—a useful term when employed correctly and as Joint Publication (JP) 3-0, *Doctrine for Joint Operations,* carefully defines this concept.[8] However, the term, taken on face value, seems to imply that military forces can set the world right, then redeploy to peacetime bases and readiness status until the next time a military cri-

sis emerges. The truth in geopolitics is that nothing is ever really over. Each resolution simply establishes a new baseline for continuing interactions—some of which the United States will like and others it will not.

The conquest paradigm has been prominent in airpower theories since the days of Giulio Douhet in the beginning of the twentieth century. However, it does not provide an adequate basis for understanding the totality of military actions. Rather than clarifying military thinking, this approach to conflict has led to deep confusion and dissatisfaction within the US military because military actions almost never attain the total war/total victory assumptions of the conquest paradigm.

The Korean War, for example, ended in a stalemate not a political or military victory. General MacArthur's efforts to achieve the goal of total victory by conquering North Korea led to Chinese intervention and a 50-year-long standoff at the 38th parallel. MacArthur's belief and training in the theories of the conquest paradigm led him to contemplate transforming a small war against Chinese forces in a puppet state into a large war in China. Even after MacArthur's failures in Korea, US military leaders held fast to the precepts of the conquest paradigm and continued to ground military doctrine and planning upon that paradigm. They found themselves just as frustrated in Vietnam. Yet, even as late as the Persian Gulf War, some Air Force planners and theorists were still convinced that the proper role of airpower was to force the total collapse of the enemy. While the collapse of the Iraqi military forces and society would have helped achieve the military goal of ejecting Iraqi forces from Kuwait, it was not necessary for achieving that goal nor was it considered to be in the ultimate political interests of the coalition arrayed against Iraq.

Conversely, some US military leaders in the Gulf War resented the Scud hunting operations of Desert Storm because they did not consider those missiles militarily effective weapons. Since the Scuds were not significant in terms of the damage they could inflict on coalition military forces or industrial capacity, these leaders believed the coalition should ignore them rather than divert valuable resources to an objective that would not contribute directly to defeat and

capitulation of the Iraqis. Because they grew up in the cold war conquest paradigm, they did not fully recognize that the entirety of military actions in the theater was only conceivable within the political context of a fragile coalition, which might easily have been broken by Israel's entry into the war against Iraq. This was precisely Saddam's intent in launching the Scuds into Israel. If Saddam broke the coalition, prosecution of the war was likely to become much more difficult if not impossible. The net result could have been a failure, regardless of how militarily efficient coalition actions might otherwise be. If Scud hunting was critical to saving the coalition, then it was one of the most important actions of the entire war, regardless of its purely military implications.

Military actions in today's geopolitical environment often require considerable restraint, not necessarily using every available weapon and not attacking every possible target but understanding the full political context of all actions. Restraint can be frustrating, and the political context within which the military operates can be enormously complicated. Yet, military actions are conducted in vain, if they do not serve real national political goals.

With the end of the cold war, the conquest paradigm became an almost wholly dysfunctional view of military actions. At least until a hostile peer competitor appears, US national survival is not likely to be at risk. When the military is called to action as in Korea, Vietnam, Kuwait, Bosnia, Kosovo, Afghanistan—and so many other places in recent years—there usually will be political considerations more important than military conquest. In such situations, the demands of military efficiency often will have to be sacrificed in favor of more important political concerns. It may not be welcome news that military efficiency will sometimes take a back seat to other considerations. In such cases, the military has a duty and responsibility to explain and request all the things it believes it needs to achieve national goals. At the same time, military professionals need to learn to accept that sometimes other national priorities will mean they do not get all the autonomy they would like.

None of these comments about the conquest paradigm and the need for a new effects-based success paradigm is meant to suggest that the military has been dropping bombs or marching around the countryside attacking enemy positions for no valid reason. In a general sense, they have always had certain desired effects in mind when conducting military actions. However, they have often pursued military objectives without direct reference to appropriate effects that would create the conditions for achieving them and with little consideration of other effects that would be created along the way. The EBO methodology is designed to correct these deficiencies as well as provide a better environment to assess the results of military actions.

Historical Background on Effects

At least as far back as World War II, some air planners were trying to implement the essential concepts of EBO. In the late 1930s, particularly at the Air Corps Tactical School, US Army Air Corps (USAAC) thinkers had developed a number of theories about air warfare, including one which came to be known as the industrial-web theory. This theory was actually quite well grounded in concepts that would later come to be known as effects-based. In its essentials, the industrial-web theory was not unlike many of the systems or system-of-systems theories of recent years. The basic idea was that a modern war machine, such as the German or Japanese armies of the time, required the support of a huge industrial complex comprised of many interlinked subelements called the web. Manufacturing plants, transportation systems, power production, delivery systems, and other critical elements made up this web. Further, there were thought to be a finite and determinable number of vital links or what we now call critical nodes, which if successfully destroyed or debilitated, would bring about collapse of the entire web.[9] In 1941 the USAAC set out to define these critical links in hopes that strategic bombardment, by itself, could bring the German and Japanese war machines to a grinding halt or, alternatively, "break the will of the people to continue resistance."[10]

Historical Examples of Effects-Based Thinking

In 1941 and 1942 the United States and Britain, working together, developed plans for a strategic bombing campaign against Nazi Germany. These plans were, in part, based on the belief that the German economy—like the British economy—was fully mobilized in support of the war effort. With this in mind and for reasons stated below, the planners decided to focus on the ball-bearing industry rather than "the electrical power grid . . . transportation network . . . and the oil and petroleum industry" as stated in the earliest USAAC plans.[11] The German aircraft industry was actually listed as first priority, but principally as an intermediate objective to enable allied bomber operations. While all these systems were considered vital to German war production, ball-bearing production was concentrated in a smaller number of facilities than the others. USAAC and Royal Air Force planners operated on the assumption that the German electrical power system was similarly constructed to the US system, which had a great deal of redundancy, robust interconnection, and, therefore, high resilience.[12] If one sector of the power grid was damaged, it was assumed the Germans would shuttle power from another. Either target set, in the end, could achieve the desired effect; but the ball-bearing industry seemed to offer the greater leverage and the promise of a quicker end to Germany's ability to sustain its war effort.

The assumptions that Germany was on a full war footing and that its electrical power distribution would prove resilient were a result of mirror imaging. That is, in lieu of actual information, planners deliberately accepted the US system as a logically satisfactory model of the German system. They were also reasonable assumptions, based on available data. Since Hitler claimed to have achieved full employment in Germany by 1939, presumably there was low probability that manpower could be expanded significantly. Hitler had begun a rapid, highly publicized, and apparently massive weapons-building program before the start of the war; so it was also reasonable to assume he was ahead of, not behind, the Allies in the pace of industrial mobilization. American and British planners assumed that Hitler would not have started the largest war in

history without first fully mobilizing his economy to fight it. Rational or not, we know—in retrospect—that the German economy was not fully mobilized until 1944, and by then the war was already lost. This was fortunate for the Allied cause and contributed substantially to the defeat of Nazi Germany, but it does not change the fact that Allied wartime planning was based on more than one false assumption. Bombing lowered maximum possible output at any given time but did not result in reduced overall output until very near the end of the war. In fact, German war production actually quadrupled between 1942 and 1944 in spite of heavy and relatively accurate British and US bombing of industrial and civilian targets.[13]

According to the US Strategic Bombing Survey, conducted after the war, the German electrical power grid was not nearly as robust as the US grid and was one of the few parts of the Nazi economy that was operating near full capacity early in the war. It may actually have been the magic thread USAAC planners were looking for in the German industrial web. Heavy and sustained attacks on power generation might have had the disastrous effects on the Nazi war economy that USAAC planners were seeking—had their initial plans prevailed—but other priorities intervened. Attacks on the ball-bearing plants produced a great deal of damage to factories, but not as much damage as was thought at the time, due to errors in assessment. The sole means of assessing damage was overhead imagery in which a photointerpreter (PI) could only see building exteriors, rather than the much more critical production machinery and equipment inside the building. Using the technologies of the time, PIs did an excellent job of assessing the percentage of roof area destroyed in bombing raids, but this turned out not to be a good gauge of the damage suffered by such important production elements as heavy equipment and machine tools under the roofs. For example, roofs of the buildings at the Schweinfurt ball-bearing plants were judged by PIs to be 75 percent destroyed after the second raid in October 1943; yet later information indicated that only 10 percent of critical equipment was damaged. Imports from Sweden and Switzerland covered immediate German production shortfalls. In the meantime, the Germans were able to sufficiently dis-

perse ball-bearing production so that it became a poor target set for the remainder of the war.[14]

This example illustrates the need to stay focused upon real, desired effects such as disruption of production in this case. Surrogates or extrapolations such as roof area destroyed are not viable means of determining actual effects. Using the percent of roof area destroyed as the critical measure actually proved counterproductive because the type of ordnance that will destroy the greatest amount of roofing (i.e., large numbers of small bombs) is relatively ineffective against the critical element of production in this case, the heavy machinery. Destroying the critical and hard to replace heavy equipment under the roofs required large, heavy bombs that could only be carried and dropped in relatively small numbers with less spectacular impact on the roof. Hard-learned lessons from this experience would actually interfere with EBO analysis a full 50 years later during the Persian Gulf War. The struggle for valid poststrike analyses during World War II would create another, similarly enduring problem for that same later conflict. During the campaign in the European theater, PIs found that photos taken during a raid tended to exaggerate the damage inflicted by the raid. The smoke, dust, and explosions captured by photos taken during a raid looked spectacular but also made near misses look like direct hits. From this experience the intelligence analysis community drew the conclusion that only poststrike photos could provide valid analytic data, which became the primary, and usually only, means of determining bombing effectiveness.

After years of round-the-clock bombing, the Allies succeeded in finding and seriously degrading two target systems that proved critical to the German war effort: transportation and oil. Transportation was attractive for operational reasons; that is, the major rail yards were easier to hit in bad weather than individual factories because they gave a very distinctive radar return. Oil was particularly attractive for assessment reasons: the military units that relied heavily on oil also relied heavily on radios the Allies could monitor, so they were able to intercept German assessments of the effectiveness of strikes. Attacks on these two systems were also highly synergistic. At-

tacks on the rail system took down phone lines, which were colocated with the rail lines, thus forcing the Germans to greater reliance on radio transmissions, which further enhanced intelligence gathering against the oil target set. At the same time, these attacks increased reliance upon less fuel-efficient road transport, which suffered from direct attack as well as the attacks on petroleum production and supplies. The leveraging effect here is obvious.

Again the USAF learned much from all these experiences, but some of the learning—such as the effectiveness of strike versus poststrike photography—was influenced by the state of technology of the time. During Desert Storm, the intelligence system continued to insist that only poststrike imagery was useful for determining strike effectiveness. This caused problems because some heavy, penetrating bombs punched through thick layers of reinforced concrete and earth to explode inside shelters and bunkers, leaving behind only a relatively small entry hole and no external indication of blast or heat. An analyst could tell little about probable damage inside the structure from the relatively small penetration hole. Combining that evidence with a strike video showing the penetration, explosion and resultant indications of overpressure inside the bunker gave a much better idea of probable effectiveness. However, the lesson that poststrike imagery was the only reliable source for analysis was long held, and it was very difficult to get analysts to consider other sources of intelligence for making battle damage assessments (BDA). As a result, in some cases bombers revisited targets that did not need to be attacked again. Because of an analytic bias toward physical damage, it was very difficult to verify systemic effects such as loss of electrical power in Baghdad.

Another problem that affected both planning and combat analysis had to do with the approach employed for targeting various systems, for example the electrical power system. World War II was a long war, fought with little concern for postwar consequences of the level of infrastructure destruction necessary to victory. Because of limitations of then state-of-the-art bombing technologies, large bomber formations had to be sent against single target complexes; and follow-up at-

tacks were necessarily infrequent. The Allies simply did not have the resources to continually attack the same complexes. Therefore, it was important to achieve maximum long-term destruction from any one bombing attack. Since it was total war, very little in Germany was off limits to bombing and little or no concern was given to postwar conditions. One specific learning outcome was that the best way to create long-term effects on the electrical power generating and distribution system was to destroy the heavy generators that produced the power. Without them there was no power to distribute. Power generators were big, expensive, and difficult to replace. Thus, their destruction would cause a relatively long-term loss of power. Under the conquest paradigm, this was a valuable lesson; but, once again, this lesson would haunt planners in a later, more technologically advanced war.

Fifty years after World War II, armed with the best of late twentieth-century hardware, the US military once again tested theories of strategic bombardment in what initially looked like another "good war." Under the tutelage of Col John A. Warden III, the Checkmate Division of the Air Staff had developed a new conceptualization of strategic air warfare, later dubbed parallel warfare. Their view of an adversary's military-industrial capabilities and requirements were strikingly similar to the industrial-web theories of five decades earlier, but they proposed to take down critical elements of the web so fast that capability to support a war effort would collapse (an effect they called strategic paralysis). Colonel Warden's team proposed to attack the will of Saddam Hussein's despotic regime and perhaps the will of the people of Iraq as well. These planners thought that such attacks might bring about a change in the regime's decision to claim Kuwait by force or turn the people against the regime and bring it down.[15] Once again, as in early planning for World War II, attacking the enemy's electrical power production and distribution system was a key element of the plan. Air campaign planners considered the electrical power system a highly leveraged target set because not only might it achieve the desired psychological effects mentioned above but also "damage to it would likely affect other critical target sets (such as military communications and the

integrated air defense system)."[16] During the planning and execution of the strategic air campaign portion of Operation Desert Storm, much of the USAF was still responding to the lessons learned in World War II, which did not always fit the new circumstances.

Once again, as was the case with Germany in World War II, US planners did not really understand how the Iraqi political, social, and economic systems worked. As a result, the potential impacts of certain coalition actions on Iraqi society were mirror imaged, which resulted in perceptual errors. Whereas in most of the world today, the opinions of the populace matter, Saddam does not really care what the people think. So long as his Republican Guards remain loyal, no one inside Iraq is likely to overthrow him. Thus, neither the idea of popular opinion pressuring him to change or of a popular revolution overthrowing him is a very practical expectation. On top of that, there was no real way to measure the will of the people or the leadership to determine whether the plan was working. It was difficult to decide how much effort to keep putting against this part of the plan. As far as the other effects on the system, the coalition likely achieved a great deal of what was expected but, once again, there is no real way to know with any level of precision whatsoever. Consequently, analysts were reduced to reporting what they could measure—physical destruction.[17] This is where the outdated lessons learned of World War II really started to pay off in a negative way. Fifty years after World War II, the USAF combat assessment system was still looking for destruction of the heavy, hard-to-replace power generators as it had in World War II. As previously mentioned, this perspective was based partially on the need to destroy something expensive and hard to repair so frequent target revisits would not be required. During Operation Desert Storm, however, this was diametrically opposed to what the planners—working under EBO concepts—hoped to do.

Unlike the combined bomber offensive (CBO) of World War II, the Gulf War was planned and executed as a brief campaign in a short war. In Desert Storm, the planners wanted to turn off the power in Baghdad with the least possible physical damage and cost to repair. They were interested in operational ef-

fects as opposed to the level of physical damage that would be created. In fact, their ideal would have been to turn off the power with a switch, so they could turn it back on again as soon as Iraq was compliant with international demands. In lieu of this capability, the military planners decided the best compromise between effect on electrical power systems in Iraq and ability to rebuild was to target transformer yards. Repairing transformer yards would be much less expensive and take less time than generator halls. The planners foresaw a dual benefit from this approach. First, the potential for quickly rebuilding critical infrastructure would offer the carrot in their vision of a carrot-and-stick approach to operations—that is, "do what we want and we will help you quickly rebuild." Second, the benefit was to save on future US aid expenditures or, in other words, the cost of the carrot that would reward Iraq's expected compliance.[18] The planners eventually carried their point, but it was not easy.

Even after the operational planners had prevailed in their point with both the joint force air component commander (JFACC) and theater combatant commander (formerly commander in chief), there was still a critical problem with assessment. The US combat assessment system was programmed to credit effect on the power grid only when generator halls were confirmed destroyed. Thus, while planners were assured by other sources that the lights were out in Baghdad, intelligence analysts were assessing only moderate effectiveness against the electrical target set. Mission planners at flying units soon figured out this disconnect and—when given a generating plant as a target—some of them would choose generator halls rather than the associated transformer fields, as aim points, to get better BDA reports from the combat assessment system.[19] While this created immediate conflicts between desired and actual targeting outcomes that were quickly recognized, a much larger disconnect between objectives and actions would not be fully appreciated until years later.

The focus operational planners maintained on desired effects and outcomes was commendable and productive, but neither the planning nor assessment system even considered

the potential long-term second- and third-order collateral effects created by total loss of electrical power in a major city like Baghdad. Resultant subsystem failures included water and sewage treatment plants and hospitals that ultimately caused more devastating long-term effects on the Iraqi civilian population than anything the coalition intended. Saddam should get much of the credit for the magnitude and duration of Iraqi civilian suffering, due to postwar neglect of the populace and recalcitrant reactions to United Nations stipulations. However, he was able to use this unintended and unfortunate effect of suffering by innocent citizens to hurt the public image of the United States in the Arab world. In some quarters, it may even have created sympathy for Saddam himself. If so, coalition actions against the Iraqi electrical system ultimately achieved the opposite of the intended policy goal. Rather than turning the people against Saddam, it allowed him to exploit the suffering of his own people.

A lot more could be said about USAF efforts to implement effects-based planning in the past, but these two examples suffice to make the point. The USAF has been implementing effects-based concepts for a long time, but doing it piecemeal, not coherently, and not really recording or codifying what has been learned through these experiences. A different, more coherent approach is required. Even today, little is known about imposition of systemic and psychological effects through military actions. The ability to affect morale and will, for instance, and the ability to coerce changes in behavior are still essentially matters of assertion. There is no comprehensive understanding of how to create such effects, whether it is truly possible or how to assess the progress and extent of such effects. This shortfall will remain true until the US military adopts an agreed concept for EBO that addresses these and other critical issues.

The Premise for the EBO Methodology

Throughout history senior US decision makers have striven to attain policy goals by creating desired effects. As noted in the previous pages, civilian and military leaders normally have objectives and a desired effect or effects in mind when con-

fronting a crisis or conflict, although they may or may not be willing—or even able in some cases—to articulate them. For senior Air Force personnel, achieving effects often equates solely to target destruction, which sometimes is referred to as effects-based targeting. Attaining specific effects applies across the full spectrum of engagement at all levels of employment and entails a great deal more than simply destroying or degrading selected targets.[20] The underlying premise of an effects-based concept asserts that affecting a particular target set in a particular way may have functional, systemic, and psychological effects well beyond simple destruction or degradation of the target set. Rather than being an end in itself, the destruction of targets should more logically be viewed as a means (creating desired effects) to achieving an end (policy goals).[21] Military power, and airpower in particular, may still seek to destroy targets; but physical destruction is only one possible desired effect within a wide spectrum of options. Specifically, it should be one of many possibilities available in a process that seeks higher order effects. Other options might include maneuver, nonlethal attack to include information operations like intrusion into an adversary's communications systems or even logistics as in a HUMRO.

Viewed another way, the challenge is to shift from input- to output-driven planning for military actions, or more specifically in the case of targeting, away from a mentality of servicing targets to producing effects that accomplish specified objectives.[22] Overall, the premise of EBO is to use both lethal (e.g., target destruction) and nonlethal (e.g., information operations) means at the tactical level to produce predetermined direct (first order) and indirect (second and third order) effects at the operational and strategic levels of employment. The net result of this precise application of military resources is to generate effects that will ripple and cascade throughout the system over time, thereby circumscribing options available to opponents and increasing those available to friendly forces.[23] Effects must not be an afterthought of the targeting process or the sole domain of assessors attempting to determine if a target was destroyed. Rather effects should be the integral linchpin that binds together the planning, execution, and assess-

ment of all military actions and the actions of other agencies as well.

Arguably airmen have moved faster than others in the military to adopt effects-based concepts, principally in the form of effects-based targeting.[24] This stems partly from the different perspective inherent in air actions, which predisposes airmen to view the entire battle space functionally, as opposed to geographically.[25] This functional perspective allows airmen to see the battle space as a whole more similar to what a JFC sees than does a surface force commander, who generally fights his war in a clearly delineated area with boundaries separating his area from those of other surface commanders. As a natural outgrowth of this perspective, airmen often question—in a way different from surface commanders—how actions in one part of the battle space are linked with and affected by actions elsewhere. For instance, airmen have been more inclined to see the possibility of operational and strategic outcomes as the result of individual tactical actions. Strategic attack is a prime example of tactical actions leading to strategic outcomes. A considerable challenge for the EBO methodology is to translate the effects-based targeting view described above from a less air-centric view into a more joint EBO perspective that leads to effects-based thinking and processes that are applicable across the entire spectrum of engagement.

On the surface, the concept of EBO appears obvious and not particularly new to many military people. On closer inspection, though, it is not widely understood and worse yet, often vastly misunderstood. Many of the wide variety of concepts exploring one facet or another of EBO, such as effects-based targeting or fires and effects, are too narrowly defined. One presumably informed source stated that disabling targets while minimizing collateral damage was the goal of effects-based targeting.[26] All of these descriptions contain truth and, in fact, effects-based targeting is one necessary element of EBO. However, such a focus excludes effects-based maneuver, logistics, mobility, and other important aspects of a real joint EBO concept. These and other such misunderstandings of EBO concepts partially explain the Air Force's and other military ser-

vices' spotty track record in application of EBO across the spectrum of engagement.

Over at least the past three decades, the Air Force has sought to enhance its ability to create ever more discrete effects. Specifically, technological improvements for the Air Force centered on the development or improvement of stealth, precision, lethality, and command and control (C^2) systems. In light of all these technological advancements, American airpower can now destroy targets more reliably with greater precision and lethality at a much lower risk to combatants than it could at any time in the past. As significant as these accomplishments are, they still have a limited impact on creating effects throughout the battle space. Most of the technological improvements discussed here have exerted their greatest influence on military actions through the physical destruction of targets. These advancements are absolutely necessary to the concept of EBO but, to the extent that thinking about their application remains mired down at the tactical level of employment, they fail to address the wide range of noncombat military actions US forces are called upon to execute today. In order to realize the full potential of EBO, both objectives and effects must be linked across all three levels of employment—strategic, operational, and tactical. In a similar fashion, it is also important to think just as hard about the kinds of effects necessary for success across the spectrum of employment from MOOTW up to and including MTW.

There are those who claim the EBO concept is already well and universally understood but has failed in the past simply because intelligence has been unable to assess results properly. Therefore, rather than further developing the concept, they believe it is only necessary to buy more sophisticated intelligence, surveillance, and reconnaissance (ISR) systems to collect and disseminate more complete information for combat assessment. Part of the confusion here results from the fact that the US military has, in fact, over the last few decades vastly improved the linkage of actions to objectives in planning processes. Linking actions to objectives has similar connotations to linking them to effects but is not quite the same thing. Generally speaking, objectives do not specify operational ac-

tions. As a result, focus can shift away from the operational objectives toward tactical outcomes. This kind of focal shift may explain a problem identified by Gen John P. Jumper, commander of US Air Forces in Europe during Operation Allied Force. General Jumper lamented that Allied Force planning had devolved to what he termed *campaign-by-target-list management*, wherein planners managed an approved target list on a day-by-day basis without reference to specific desired effects.[27] A further difference between objectives-based planning and effects-based planning—not mutually exclusive—is the relative focus on desired versus undesired outcomes. Objectives are things the planning forces want to happen. Effects-based planning also explicitly considers additional things beyond what the action is intended to accomplish that may happen as a result of planned actions.

All of the foregoing material suggests that there is a long way to go yet before EBO is really implemented. It is necessary to document and codify what the concept really means for military applications, how to organize mentally and physically to execute the concept, and what the various effects-based terms that get tossed around actually mean. It makes sense to start with an attempt to standardize terminology since it is difficult, at best, to debate a concept without agreed meanings to the requisite terms.

Conceptual Basis for Effects

This section expands on the EBO foundation presented in the May 2002 ACC EBO white paper. A definition for the term *effects* requires a brief examination of the contextual framework surrounding the change in approach to military actions proposed here. The current conceptualization of EBO reflects primarily an airman's perspective, but it should prove flexible enough to be appropriate for all joint and combined actions. Although all the services use the term *effects* and have concepts associated with effects, only recently has a definition of this term appeared in doctrine.[28] Moreover, while effects-based concepts exist throughout the joint community and appear to

be highly regarded in many quarters, these concepts are still not universally well understood.

Definitions and Categorization

The basis for the definition of the term *effect*, as described in this paper, is "the power to bring about a *result*, i.e., to influence." This description requires some modification, however, to be fully compatible with the overarching concept of EBO. In this case, it is important to note that the effect of a given action may set off other changes or one event may trigger or cause subsequent outcomes.[29] Figure 1 illustrates this dual nature of effects as related to military actions.[30] As shown, planning centers on the effects or results desired to achieve the stated objectives, while the execution portion of the figure depicts how effects act as triggers that cause subsequent actions or outcomes. Combining these two ideas provides a basis for developing a comprehensive definition of effects.

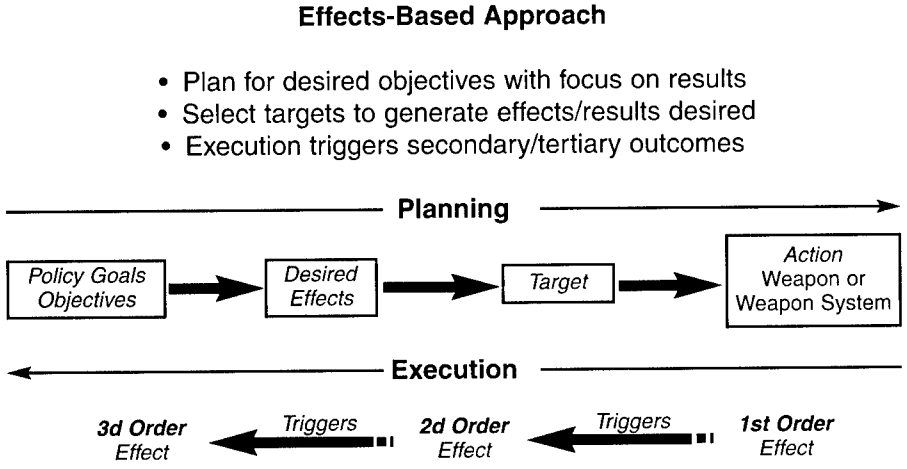


Figure 1. The Dual Nature of Effects

From what has been stated so far, it is apparent that the term *effects* is both inherently complex and requires a complete definition to promote understanding among military members. Based on the information presented above, the au-

thors recommend the following concise definition for the term *effects*: Effects consist of a full range of outcomes, events, or consequences that result from a specific action.

This definition provides a departure point for categorizing and classifying associated concepts. In the most basic sense effects can be broken down into direct and indirect effects.[31] A direct effect is the result of actions with no intervening effect or mechanism between act and outcome. Direct effects are usually immediate and easily recognizable. For example, bombing enemy surface-to-air missile (SAM) sites and associated C^2 facilities may produce the direct effect of physically destroying those targets. Direct effects can trigger additional outcomes referred to as indirect effects, which may be classified as those effects that are created through an intermediate effect or mechanism to produce a final outcome or result. Going back to the SAM site example, a possible indirect effect might be the refusal of operators at other SAM sites to target aircraft out of fear of being attacked. Direct and indirect effects may be physical, functional, or psychological in nature. Indirect effects also may be systemic and tend to be delayed and/or may be difficult to recognize. Indirect effects are often the cumulative or cascading result of many combined direct effects.[32]

The relationship between direct and indirect effects can be seen in the example of an attack on an enemy's C^2 system. Destroying a single communications node creates a direct effect: that specific communications node is degraded or ceases to function. The cumulative result (i.e., indirect effect) of multiple strikes against a number of similar and related targets could result in achieving the air planners' true objective: undermining the enemy's ability to command military forces effectively. During the Gulf War, attacks against Saddam Hussein's C^2 facilities forced his military into autonomous operations, something they were neither trained nor equipped to handle. As noted earlier, indirect effects usually occur over time, and it may take an indeterminate period of time before the overall lack of communications has a deleterious effect on the enemy.[33] Overall, the combination of direct and indirect ef-

fects can achieve the ultimate objective of any action—to compel or shape a desired result.

First, Second, and Third Order Effects

First order effects are synonymous with direct effects. Second and third order effects constitute indirect effects (see fig. 2). Maj Jay M. Kreighbaum provides the example of first/second/third order effects.[34]

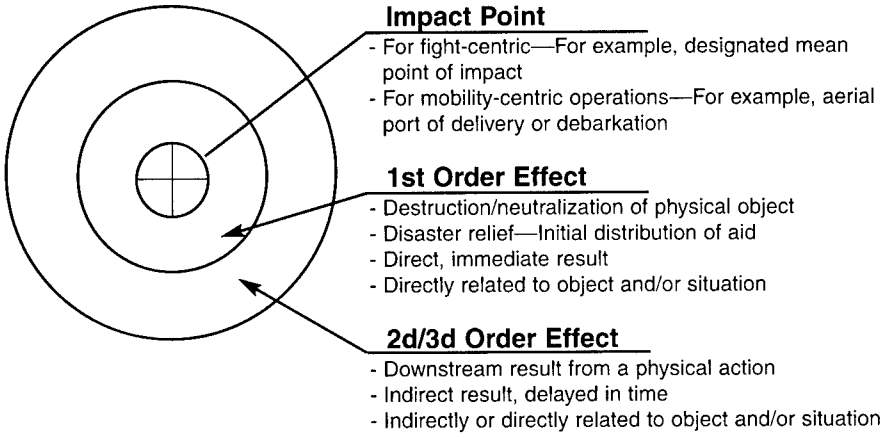
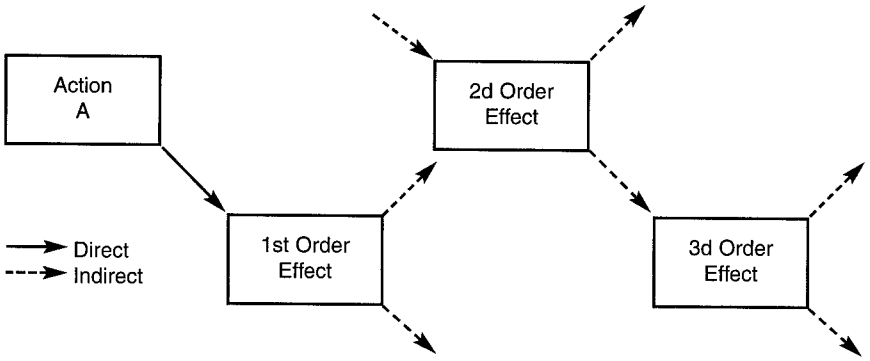


Figure 2. Example of First/Second/Third Order Effects

First Order (Direct Effects). First order effects result immediately from an action. The results are directly attributable to a military attack on a target or other actions at a specific location and occur immediately or very nearly immediately after the specific actions.[35]

Second/Third Order (Indirect Effects). Those effects that are created through an intermediate effect or mechanism, thereby producing a final outcome or result. Simply stated a causes b, causes c, causes—see figure 3 for the relationship of first, second, and third order effects.[36] Furthermore, second and third order effects are indirect effects, which may be functional, systemic, or psychological in nature. Indirect effects

tend to be delayed and typically are more difficult to recognize than direct effects.[37] Depending on the situation, indirect effects may occur over an indeterminate period of time. An example of second and third order indirect effects would be disruptions in the electric grid, which yields rolling blackouts that disrupts petroleum deliveries to airfields and that disrupts air operations.



Source: Briefing and paper, USAF Doctrine Center, Maxwell AFB, Ala., subject: "Strategic and Indirect Effect: Defining and Modeling," 11 August 2000.

Figure 3. Complexity of Higher Order Effects

Cumulative and Cascading Effects

Direct and indirect effects can be cumulative or they can cascade through the course of an action. Cumulative effects result from the aggregate of many direct or indirect effects. This aggregation of effects may occur at the same or at different levels of employment. Typically, a cumulative effect flows from lower-to-higher levels of employment and occurs at the higher levels; however, it may occur at the same level as a contributing lower-order effect. As an example, increased operational-level air superiority could be the cumulative effect of destroying numerous SAM sites at the tactical level.[38] A second example would be the distribution of humanitarian aid at nu-

merous airports throughout a country or region with the cumulative effect of providing the necessary food and disaster relief materials to the majority of the population requiring such aid. Although cumulative effects may occur at the tactical level of employment, they most typically occur at the operational or strategic levels of employment.

Indirect effects can ripple through an enemy target system in a combat scenario or a situation in MOOTW and often affecting other systems. Most frequently indirect effects cascade or flow from higher to lower levels of employment. For example, when an enemy central headquarters is destroyed the effects cascade down through the enemy echelons to ultimately disrupt numerous tactical units on the battlefield (an admittedly fight-centric example).[39] Similarly, in an example involving mobility operations, working directly with a host-nation government can have a positive cascading effect on the overall efficiency and success of humanitarian operations within that nation. When supplies are given directly to the government, distribution to the distressed populace may be enhanced through a cascading effect.

Virtually no part of a target audience or its infrastructure is truly isolated.[40] In other words, effects, whether direct or indirect, have a ripple or distributive impact throughout the target environment or system whether a nation-state or a loosely knit international terrorist group. The cumulative and cascading nature of direct and indirect effects contributes to their distributive character.[41] With successive layers of indirect effects, it becomes increasingly difficult to precisely predict and measure outcomes. Historically, it has proven extremely difficult to predict with any degree of certainty beyond the third order effects discussed above. This characteristic highlights the fact that there are few, if any, clear lines of demarcation for effects beyond the third order. Table 1 shows the increasing complexity involved with such effects within an extremely complex and interrelated system such as an enemy state.[42] Nonstate actors, such as terrorist organizations and networks also may be inherently complex. Furthermore, Table 1 provides examples of effects across the levels of employment and ties together the categories and concepts presented to this point.

Table 1

Relationship of Objectives, Effects, and Targets

Objectives ⟷ Effects ⟷ Targets/Actions

Objective	Indirect/3d Order Effects (Systemic)	Indirect/2d Order Effects (Functional)	Direct/1st Order Effects (Physical)	Target/DMPI Distribution Point
War making and sustainment capacity at front reduced	Movement of military logistics delayed to front	Road traffic halted accessing bridge; Traffic diverted	Road bridge "functionally" destroyed	Specific aim points to drop bridge span
Friendly air superiority advanced; adversary air defense disrupted	C^3 within region disrupted and disabled	EW/GCI site disabled; Sector acquisition capability disrupted	Communications relay van destroyed	EW/GCI site communications node
Sustain the populace through the winter months	Refugees receive necessary food and shelter	Food and supplies reach distribution points/refugee camps	Airlift bridge established in country for distribution	Mobility aircraft land at airports
Desired Outcomes	**Trigger←Cause**	**Trigger←Cause**	**Trigger←Cause**	**Target/Action**

Legend:
C^3—command, control, and communications
DMPI—desired mean point of impact
EW—early warning
GCI—ground controlled intercept

Source: Jay M. Kreighbaum, "Force Application Planning: A Systems-and-Effects-Based Approach," Class 7 (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, Ala., 1997–98), 76.

Collateral Effects

Collateral effects are those outcomes that result when something occurs other than what was intended. In a broad sense collateral effects are any effects achieved beyond those for which the action was undertaken and may be either positive or negative to the planners' intent. In a negative sense, collateral effects may be incidental direct or indirect effects that cause unintended and unwanted injury or damage to persons or objects. On the positive side collateral effects may generate outcomes that prove beneficial to ongoing military actions. The net result is that planned first order effects will invariably gen-

erate subsequent effects that were unintended and/or unanticipated. It is important to distinguish between collateral damage and collateral effects. According to Air Force Instruction 14-210, *USAF Targeting Intelligence Guide*, collateral damage is broadly defined as the unintentional or incidental damage affecting facilities, equipment, or personnel that were not targeted. Such damage can occur to friendly, neutral, and even enemy forces. This definition seems unnecessarily restrictive as it implies collateral damage is solely negative and never results in benefit to the plan.

During operational planning, potential collateral effects evaluation should consider second and third order effects that may impact outcomes either positively or negatively. World War II provides an excellent example of collateral effects. In preparation for the Normandy invasion, the Allies attacked railroad marshalling yards in a major air action to disrupt the reinforcement and resupply of German divisions in the invasion area. The direct effect of actions against the rail systems of both France and Germany was successful interdiction and disruption that, in turn, indirectly isolated the Normandy battlefield from supporting forces and supplies. Additionally, there were two collateral effects associated with these air attacks. The destruction and disruption of the rail system had a positive effect by contributing to the collapse of the overall German war economy. Conversely, destroying these marshalling yards had the negative collateral effect of denying the Allied forces use of the same railroad systems to move troops and logistical supplies forward in the ensuing ground campaign in France. During World War II there may have been no other choice, even had the negative collateral effects been anticipated. Today, however, planners might consider other means for achieving the desired effects. Perhaps targeting only very key points of the rail system in a manner that would allow quick repair by the Allies similar to the attacks against Iraqi electrical distribution in Desert Storm described earlier. Collateral effects should be a major, deliberate consideration in planning, executing, and assessing military actions on any scale.

Physical, Functional, Systemic, and Psychological Effects

The definition proposed for effects previously alluded to physical, functional, systemic, or psychological outcomes, events, or consequences as they relate to military actions. This categorization—physical, functional, systemic, and psychological—most closely matches that used by the US Air Force in assessing its wartime effects.[43] Thus, this categorization seems quite useful for the purposes intended here due to its inherent relationship to current combat assessment (CA) terminology.[44] These categories are an integral part of the argument presented in this study. It is important, therefore, to carefully examine each category of effects to comprehend their interrelatedness.

Physical effects are created by the direct impact, through physical alteration, on an object or system targeted by the application of military resources. In a conflict, the primary purpose of a physical effect is to damage, disrupt, or neutralize a target or group of targets through the application of military force to achieve the desired effect.[45] In other actions it may actually be construction of some key infrastructure or other positive action that physically affects a target audience. In general, physical effects are direct or first order effects. Physical effects are closely related to, although much broader ranging than, the physical-damage assessment performed by intelligence analysts. A physical-damage assessment is an estimate of the extent of physical damage or change to a target based on observed or interpreted alteration.[46]

Functional effects represent the direct or indirect effects of a military action on the ability of a particular target or object to function properly and perform its mission. Moreover, in assessing these particular effects, there is this question: To what extent has the function of the particular target or target set been degraded relative to the objective in the attack or other action? In both fight-centric and nonfight-centric scenarios, functional effects are extremely important, since these effects may be key indicators of the overall success of the particular action. Functional effects also have a direct relationship to assessment in that a functional-damage assessment estimates

the remaining operational capability of a targeted facility or object. A functional assessment is more difficult and detailed than a physical-damage assessment. In the EBO methodology, this area of analysis must be expanded to include the functional-impact assessment of positive events, such as construction of infrastructure to support friendly target audiences.

Systemic effects are those indirect effects aimed at affecting or disrupting the operation of a specific system or set of systems. The distinction between functional and systemic effects hinges upon what exactly is affected as defined by the objective. If it is a target such as a transformer yard, then a functional effect is what is desired. Conversely, if the desire is to affect an entire system such as an electrical power grid, then it is a systemic effect.[47] The loss of power from an electrical power plant could affect numerous systems including communications, C^2, and petroleum production among others and hence have cumulative or cascading effects. On the down side, destruction of main electrical power grids usually has the collateral effect of disrupting power to such facilities as hospitals and sewage-treatment plants. With regard to assessment, Air Force Pamphlet 14-210, *USAF Intelligence Targeting Guide*, 1 February 1998, provides insight on what is termed target-system assessment. Target-system assessment uses BDA information that is then fused with functional damage to a target system and an evaluation is made of the overall impact on the system's capabilities. Once again, the EBO methodology will require expanding the current view of target-system assessment to include positive effects on friendly systems for actions such as MOOTW and HUMRO.

Psychological effects are the results of actions that influence emotions, motives, objective reasoning, and ultimately the behavior of foreign governments, organizations, groups, and individuals. These effects may be either direct or indirect effects resulting from such military actions. For example, strategic attacks—in particular—against an adversary may have the effect of demoralizing enemy leadership, military forces, and the population, thus affecting the enemy's will to wage war. On the other hand, it may be important in other types of actions to

achieve positive psychological effects on a given target audience. In either case, achieving a psychological effect can be an elusive goal and one that is extremely difficult to measure accurately.[48] The concept is a very important one, however, and should not be discarded or downplayed simply because of the difficulties involved in defining and measuring success.

There is a natural linkage among physical, functional, systemic, and psychological effects. The linkage may vary in degree but appears to always be present. For example, a bridge may be physically destroyed. As a result, the bridge is no longer functional, and its lack of functionality degrades the transportation system. Furthermore, the loss of the bridge may have a psychological impact on the adversary, especially if it was one of the primary avenues of escape or retreat in the face of advancing military forces. The important aspect is to develop a better understanding of the inherent interrelationship of effects and to incorporate this understanding into planning, execution, and assessment of operations.

Tactical, Operational, and Strategic Level Effects

The so-called levels of war or spectrum of conflict are doctrinal perspectives that clarify links between strategic objectives and tactical actions. This perspective tends to limit doctrinal discussions to fight-centric scenarios. To avoid that limitation, as explained previously, the terms *levels of employment* and *spectrum of engagement* are used in lieu of levels of war and spectrum of conflict. Although there are no finite limits or boundaries between them, the three levels are generally described as strategic, operational, and tactical. In a broader sense the levels actually apply to both war and MOOTW, since effects-based operations may be employed anywhere in the spectrum of engagement, from peacetime through MTW.[49] Air Force Doctrine Document (AFDD) 2, *Organization and Employment of Aerospace Power*, captures the association precisely when it states, "the focus at a given level of war is not on the specific weapons used, or on the targets attacked, but rather on the desired effects." Effects are the tactical, operational, or strategic level outcomes that military actions are in-

tended to produce. Overall, effects can be defined as strategic, operational, or tactical, based on their contribution to achieving objectives. Interestingly, tactical, operational, and strategic effects are interwoven throughout direct and indirect effects. In essence, tactical, operational, and strategic effects provide an overarching umbrella encompassing all effects. The fundamental relationship of these effects to that of direct, indirect, and other associated effects is portrayed in figure 4.

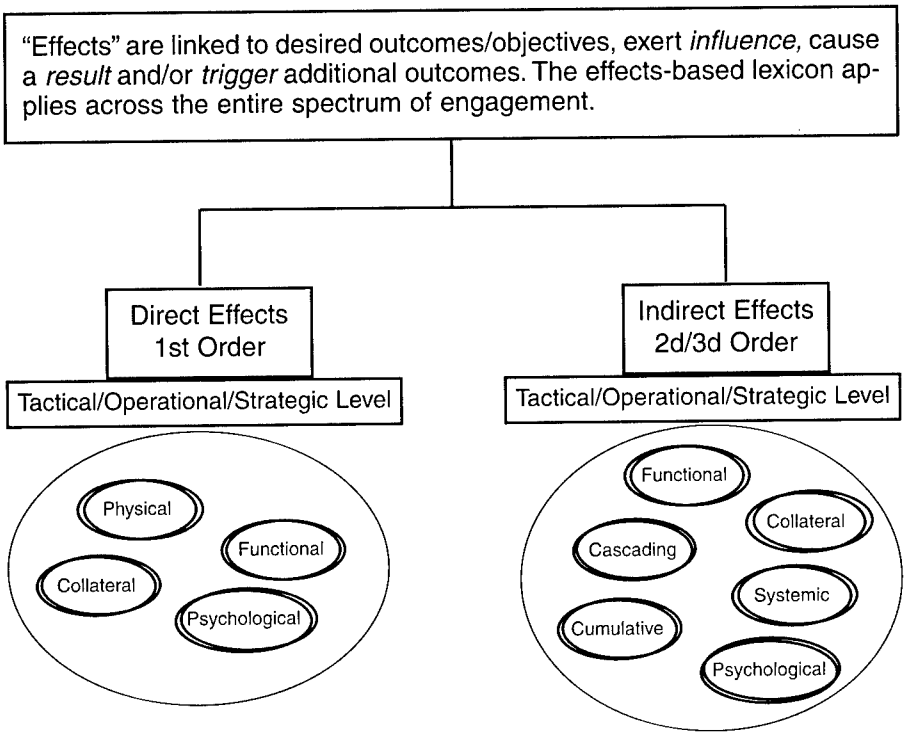


Figure 4. Fundamental Relationships of Various Effects

Strategic-level actions involve activities associated with the effort as a whole. Strategic effects contribute to affecting a specific target audience's overall political, military, and economic capacities as well as its psychological stability.[50] In a combat scenario, a strategic effect is the disruption of the enemy's

strategy, ability, or will to wage war or carry out aggressive activity through destruction or disruption of his COGs or other vital target sets. COGs may typically include command elements, war production assets, fielded forces, and key supporting infrastructure. Strategic effects can result from the actions of air and space or surface forces at the lower levels of employment. An example of the latter would be destruction of the enemy army on the battlefield. Such a tactical and/or operational-level action would, in turn, impair the enemy strategy to the point where it is forced to cease fighting. In this case, the cumulative results from the tactical level are eventually felt at the strategic level.[51] Strategic effects in general require a longer time to manifest than do effects at the operational and tactical levels. However, it is important to note that there are instances of employing military forces aimed at producing the direct strategic effect of enemy defeat with no intermediate level effects on enemy forces involved.[52]

The operational level describes activities associated with campaigns, major actions, and activities that affect an entire theater of operations. At this level, efforts focus either on the war-making potential of the enemy or the ability to have theater-wide influence in a nonfight-centric scenario. The principal focus at this level is on enemy forces, an enemy's operational COG, or the conditions behind the specific circumstances in a MOOTW. Operational-level effects contribute to reducing and unbalancing an adversary's capacity to conduct successful campaigns and wage war. These effects usually take less time to be realized than do strategic ones but are less immediate than effects at the tactical level.[53]

Tactical effects are the result of an action or actions at the individual unit level. Such effects can be either direct or indirect and typically act in concert with other tactical effects to produce results at higher levels of employment. Tactical effects generally occur on a localized basis and are immediate and of short duration. Most often they contribute to overall success through cumulative outcomes of missions, engagements, and individual battles. Significant examples include air superiority, isolating enemy units on the battlefield, and rapid deployment of forces to the arena of action.[54]

In fight-centric scenarios, force can be used to either destroy or control the enemy. The use of force to control rather than destroy an opponent's ability to act lends a different perspective to the most effective use of military power. However, the ability to influence either an adversary or a situation depends on the strategic events stemming from an overwhelming impact of direct and indirect effects. Creating the right effects does not necessarily imply the ability to manipulate all individual events or actions at the tactical level of employment. For example, during the Gulf War, Iraq was able to launch individual aircraft sorties; however, because Iraq's C^2 and air defense systems were rendered ineffective by coalition actions, such individual sorties were of negligible consequence.[55] This effect resulted not only because the Iraqi C^2 system was severely disrupted but also because coalition systems detected virtually every move they made.

Effects-based terminology provides a useful foundation for EBO theory. The new terminology and information used herein may appear a bit overwhelming and take time to fully digest. However, the abundance of terminology is an indicator of the all-encompassing nature of EBO. Overall, the lexicon should serve as a common reference point for EBO terms and definitions that may be incorporated in service and joint doctrine. A full listing is presented of recommended EBO terms and definitions in the final section of this study.

A General Theory of Joint Effects-Based Operations

While recognizing that military actions usually create immediate physical effects, the focus of the EBO construct presented here transcends immediate physical results. Therefore, this concept does not address results in terms of destruction but in terms of outcomes that may or may not include destruction. EBO does not attempt to replace attrition or annihilation as goals of military actions in situations where they may be appropriate. It simply recognizes them as two specific types of military outcomes that might be useful in certain cases but certainly not in all cases. Attrition and annihilation

play smaller and smaller roles in contingencies as they move from the higher-intensity to the lower-intensity end of the spectrum of engagement. They will rarely, if ever, play any role in HUMRO and noncombatant-evacuation operations. Effects in these kinds of contingencies will be more inclined toward constructive—both physical and psychological—accretion of positive factors and outlooks and protection of endangered and/or beleaguered groups.

Even where destruction, attrition, and annihilation are used, the real desire is often to create higher-level psychological effects like decreasing the will of a people to resist (e.g., World War II strategic bombing), or altering the decision-making process of a national leadership (e.g., Operation Desert Storm). On the other end of the spectrum, building the will of a people to defeat oppressive conditions may be the desired goal (e.g., Berlin airlift). This highlights the fact that EBO is not centered upon an adversary but, rather, on the conditions necessary to achieve success in any action.

The EBO Methodology Overview

The EBO methodology appears to be an optimum way to deal with the wide range of actions confronting the United States today. It can be applied to virtually every national security activity, including all military actions. It does not apply only to targeting, fires, or attack. Effects-based supply, for example, can be the key to success in a HUMRO or peacetime engagement with a friendly foreign government or military force. For instance, "accumulation of sufficient foodstuffs and medical supplies at forward distribution points to guarantee 100 percent availability through the winter months," might be a very useful effect to help achieve the objective of averting starvation and disease in a population victimized by a major natural disaster. Focusing on just one aspect of military actions, like targeting, would greatly reduce the overall efficacy of the EBO methodology.

Planning, executing, and assessing operations designed to attain the effects required to achieve desired national security outcomes necessarily implies foreknowledge of specific achievable conditions believed necessary for attaining specified ob-

jectives. This requires military professionals to undertake a wide range of studies to define the term *desired effects* possible in given situations and how to create them. The taxonomy of effects provided in this concept—physical, functional, systemic, and psychological—offers a starting point and some guidance for undertaking these studies. For instance, it suggests that analysts will need to study some rather esoteric subjects, such as psychology and decision-making theory, to determine the range of psychological effects that might be attempted and how to approach them successfully. At the same time more concrete studies will need to continue—like nodal analysis of military systems and organizations, war industry and national infrastructure—to understand desired physical, functional, and systemic effects. However, important as it is to understand the kinds of effects possible in given circumstances, efforts must go well beyond this to also consider possible consequences besides the desired effects.

The idea that a proposed course of action will result in a single desired outcome has been described as "folly" by at least one author.[56] Indeed, it is folly, and yet military planners have often been guilty of only focusing on the desired outcomes in military actions. The current focus on objective planning in joint doctrine contributes to this fallacious thinking. This is not meant to imply that planning should not be based upon clearly defined objectives. Planning to meet objectives is important and must continue, but properly applied, effects-based methodology will add analytical rigor to greatly increase the probability of success in any given case. Objectives define an end state that actions are designed to achieve. The objectives themselves can be further defined by a set of conditions, or desired effects, that must be created to achieve each objective. When actions are planned without reference to the conditions required to achieve policy goals, commanders and planners tend to see only the relative probability of positive outcomes, based upon their perception of past success or failure when the planned actions were applied. For example, since destroying transportation nodes was useful in defeating the German army in World War II, American planners tend to think destroying transportation nodes will be useful in defeat-

ing any army, anywhere, anytime. In a very generalized sense, this may actually be true, making the concept all the more seductive. In all cases however, even the World War II example that leads down this path, there are negative collateral effects associated with this approach. If planners carefully consider the conditions (i.e., effects) that must be established to achieve objectives in a given case and the underlying causal linkages they expect will achieve these effects, they will sometimes find potential negative collateral effects outweigh the positive intended effects.

Relationship between Objectives and Strategies

One reason for the lack of consistency in applying effects-based thinking to military operations is reflected in service and joint doctrine. The concept of effects-based operations is discussed to a limited extent in US military doctrine today, but no methodology is offered to systematically apply it. For example, JP 3-0 states that the levels of war (strategic, operational, and tactical) are doctrinal perspectives that clarify the linkages between strategic objectives and tactical actions. Furthermore, these levels are defined by their effect or contribution to achieving strategic, operational, or tactical objectives; but no methodology for applying or analyzing these linkages is offered.[57] In addressing this issue, AFDD 2 explains and expands on the objective-strategy-effect relationship by employing what has been colloquially termed the Z-diagram (fig. 5). This diagram is the result of much of the work done on the objectives-based approach at the RAND Corporation and illustrates the interrelationship between objectives and strategies at the various levels of war. Each level should have a clear set of objectives, which, through certain mechanisms form a strategy for that particular level. Objectives normally are derived from the objectives at the next higher level of war and may devolve from higher-level strategies.[58] As the actual operation progresses, assessment of lower-level results—or effects—suggests modifications to higher-level strategies or objectives. Unfortunately, neither service nor joint doctrine fully clarifies how and why effects and mechanisms relate to objectives and strategy. There is no definition for effects in service

or joint doctrine; and no methodology that adequately captures why effects are important considerations, how they might be analyzed, and what they contribute to operations or attainment of objectives.

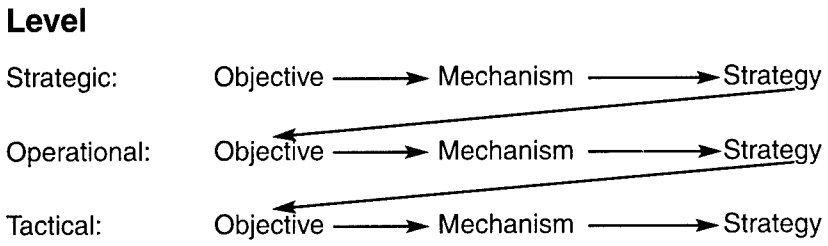


Figure 5. Relationships between Objectives and Strategies

The lack of such a methodology in doctrine explains why an effects-based approach to warfare has not been prevalent in military history and why a purely objectives-based approach may be poorly executed. Fully articulating an EBO methodology would be extremely beneficial to military commanders in planning, executing, and assessing campaigns.

The first step must be to define certain fundamental terms such as *effect* and *EBO.* As stated previously, the term *effect* refers to a full range of outcomes, events, or consequences that result from a specific action. EBO is defined as those actions taken against enemy systems designed to achieve specific effects that contribute directly to desired military and political outcomes. To expand on this definition slightly, decision makers must have a clear idea of what it is they are trying to accomplish, what actions might be taken, and how the proposed actions will contribute to the desired end state. They must also have some reasonable explanation of why they expect the operations to work, that is, an anticipated causal linkage between action and effect.[59]

Based upon these definitions, the EBO methodology is a means for planning, executing, and assessing operations designed to attain the effects required to achieve desired national security outcomes. This methodology really is a refinement or evolution of the objectives-based planning methodology that

has been clearly and carefully incorporated in US military doctrine over the last decade by implementing a strategies-to-tasks approach for planning military operations.[60] Objectives-based methodology connects clearly stated objectives to proposed tasks or actions, essentially through a process of historical analysis, and then refines them to operational plans through the strategies-to-tasks approach (fig. 6).[61] On the positive side this methodology focuses on objectives at every level of employment and ties tactical events to operational and strategic objectives. However, the major limiting factor in this approach is it does not take into account why such tasks or actions will cause the objectives to be achieved.

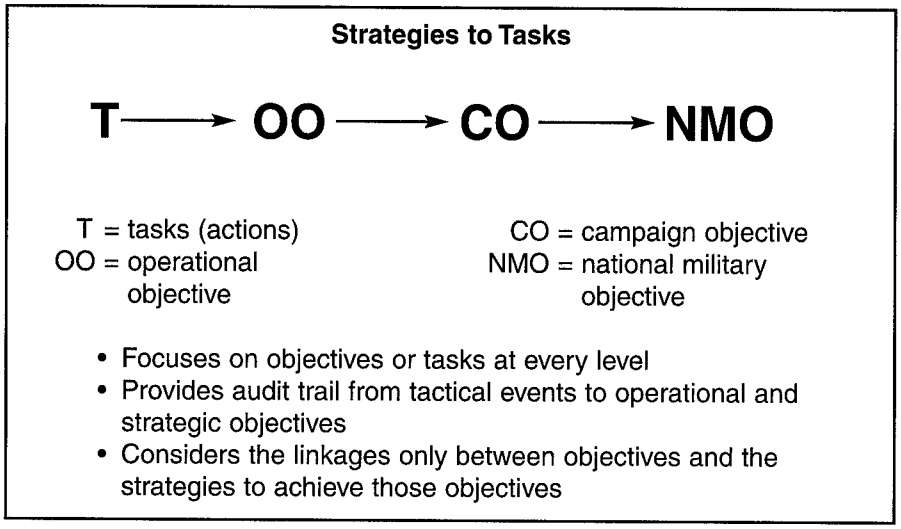


Figure 6. Objectives-Based Methodology

Objectives-Based Methodology

With the objectives-based approach, past actions are reviewed in order to look for examples that have achieved objectives similar to the current ones (either formally through an established process or informally through individual thought processes). Even seemingly innovative actions are usually evolutions of past successful operations. For example, all permu-

tations of attack on important national infrastructure are essentially based upon the same general assumptions; if national functioning can be sufficiently disrupted, war-making capacity or the national will to make war will also be disrupted. Attacking transportation systems, electrical power distribution grids, petroleum production and storage, and similar infrastructure has worked—to varying degrees—in the past and can be expected to work, to varying degrees, in the future.

For example, the US attack on the Confederate economy during the American Civil War made a major contribution to victory and followed a two-fold approach by attacking capability and will. Toward the end of the conflict Gen Ulysses S. Grant continuously attacked Confederate capability by pursuing Gen Robert E. Lee's army in Virginia.[62] Two major campaigns were designed to break the will of the Confederacy: Sherman's march to the sea and Sheridan's devastation of the Shenandoah Valley seriously weakened Confederate agriculture. Additionally, a naval blockade denied the South manufactured goods, thus fostering inflation and reducing Confederate morale. Perhaps as important, the blockade restricted southern exports of cotton, which undermined the financial health of the South.[63] Ninety years later, in a generally more industrialized age, the UN attack on the North Korean economy did not have a similarly significant impact. While land, sea, and air operations devastated the North Korean economy, the war continued in a long, bloody stalemate. Unlike the Confederacy, North Korea received critical logistical support from protected sanctuaries in China and the Soviet Union that could not be interdicted by a naval blockade. Diplomacy and airpower, the latter restricted to operations entirely within Korea, could not halt the flow of supplies. Even though the North Korean economy was destroyed and a sustained air campaign impeded communist operations, the communists were able to support a larger army at the end of the war than the original one that invaded South Korea in June 1950.[64]

The EBO Methodology Described

The EBO methodology takes the objectives-based process a step further, allowing planners and commanders to examine

conditions and causal linkages through which actions lead to objectives (fig. 7). This methodology makes it easier to understand why a particular action may work well in some cases and not so well in others. It may also highlight additional options. This point can be illustrated using the concept of information superiority as discussed in US joint doctrine and *JV 2020*.

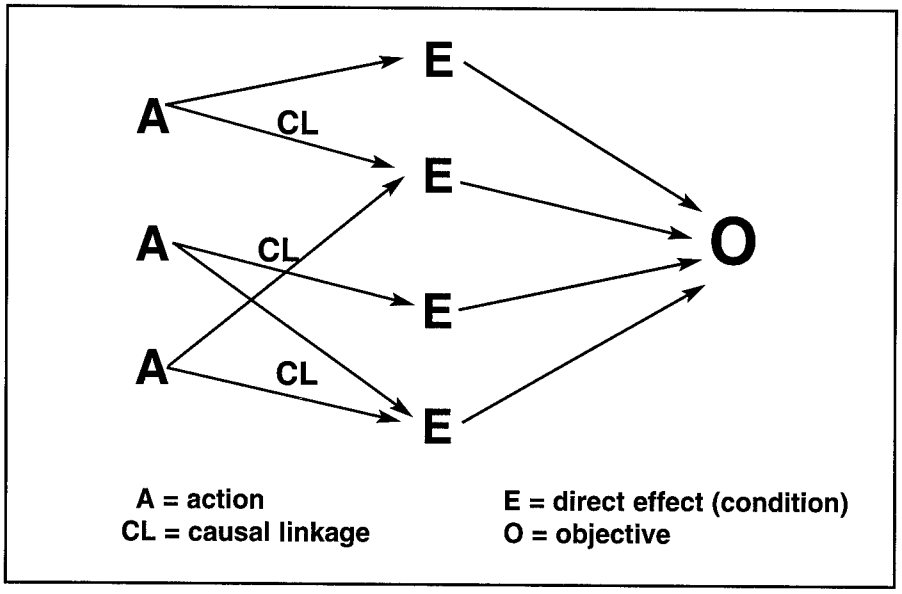


Figure 7. The Effects-Based Methodology

Information superiority as a military objective—such as maneuver dominance, freedom of navigation, or air and space superiority—can be defined as a set of conditions or effects that US forces desire to create in virtually all operations. This set of desired effects, once attained, is expected to achieve the objective (information superiority). In a generalized sense, these effects are the ability to collect, disseminate, manipulate, and use as much valid information as possible, while denying the same ability to an adversary. There are a number of different actions that can contribute to achieving these desired effects. Causal linkages explain why planners think the proposed actions will create desired effects. Figure 7 illustrates the centrality of causal linkages to the

EBO methodology and how this kind of analysis can help planners understand whether they may reasonably expect the proposed actions to create the desired effects under existing circumstances.

To exemplify, disruption of enemy C^2 networks has, in the past, contributed to information superiority. One historically proven action to attain this particular effect is to damage or destroy C^2 centers. There are a number of potential causal linkages connecting this action with the desired effect, but a couple of key ones would be the enemy's inability to receive and communicate commanders' orders and perhaps the death of key commanders themselves. Another possible action to attain a similar effect would be to intrude in the enemy's C^2 structure using information operations systems and techniques. If done cleverly, false orders and misdirections could be inserted into the enemy system (action), causing the troops to draw false conclusions about their mission (causal linkage) which, in turn, brings them to act favorably to friendly plans, thus disrupting the enemy commanders' plans (desired effect). Either action would contribute to attainment and maintenance of information superiority (objective) under the right circumstances, but each through entirely different causal linkages.

A real-world example may help to further illustrate this point. During most of Operation Desert Storm in the Persian Gulf, coalition forces enjoyed a favorable information differential over Saddam Hussein's army in Kuwait. This differential became obvious to both sides during the Battle of al-Khafji when Iraqi forces occupied the evacuated Saudi border town but were unable to hold it. Information superiority allowed coalition forces to monitor Iraqi movements, while preventing the Iraqis from acquiring information on coalition troop movements or properly coordinating their engaged and reinforcing forces. Inside the town, a small contingent of trapped US Marines was able to relay information on Iraqi dispositions and movements.[65] At the same time, in the air, an E-8 joint surveillance, target attack radar system (JSTARS) aircraft was able to monitor Iraqi supporting movements and pass that information to a horde of attacking aircraft.[66] As a result, the Iraqis with six to eight times more artillery and four to six

times more armor available than the coalition were unable to hold the town. By relentlessly attacking Iraqi communication nodes and denying them useful information on coalition positions and movements (action), the coalition was able to deny Iraqi forces any useful information on the coalition forces and disrupt their ability to communicate and coordinate movements (effect). The coalition achieved this effect by destroying communications equipment and intimidating Iraqi forces (causal linkage).[67] Achieving the objective of information superiority conferred tremendous tactical and operational advantages upon the coalition in this case. This vignette is not intended to tell the whole story of al-Khafji but merely to illustrate how analysis of the action-causal linkage-effect-objectives relationship can help in understanding the potential contribution of a particular action to achieving objectives by creating desired effects.

Not only does this type of analysis help to understand why a given action may work but also it is likely to reveal the fact that historically relevant actions may not work in a particular case. This is true, once again, because it is not only the action itself that achieves the effect but also the relevance of the causal linkages activated by the action, in light of the current situation, that determines whether or not the effect is achieved. In the case discussed earlier, given a decision between destroying or exploiting enemy C^2 nodes, this type of analysis would also reveal the basic conflict in the two alternatives. For example, destroying a C^2 node that is being fruitfully exploited through intrusion could actually impede progress toward the objectives.

As noted previously, EBO itself is not new; certain brilliant commanders have recognized it at least since Sun Tzu's time. Formalizing EBO in doctrine would simply bring analytic methodology and planning processes into line with the way complex problems, like warfare and other military operations, are solved in the real world. If current conditions are not serving national objectives, actions are taken to create new conditions that are expected to achieve the national objectives. Causal linkages, subject to examination in light of relevant information, explain why the proposed actions are expected to work.

This examination, to be most useful, must look not only at the probability of achieving the desired effects. It must also ask what else may happen because, in a complex world, no action ever creates only a single outcome. Therefore planners must always ask what else and never accept nothing for an answer. There is always something else—collateral effects that may be positive or negative to desired outcomes. To the extent possible their potential impact should be considered before any action is taken rather than afterwards (fig. 8).

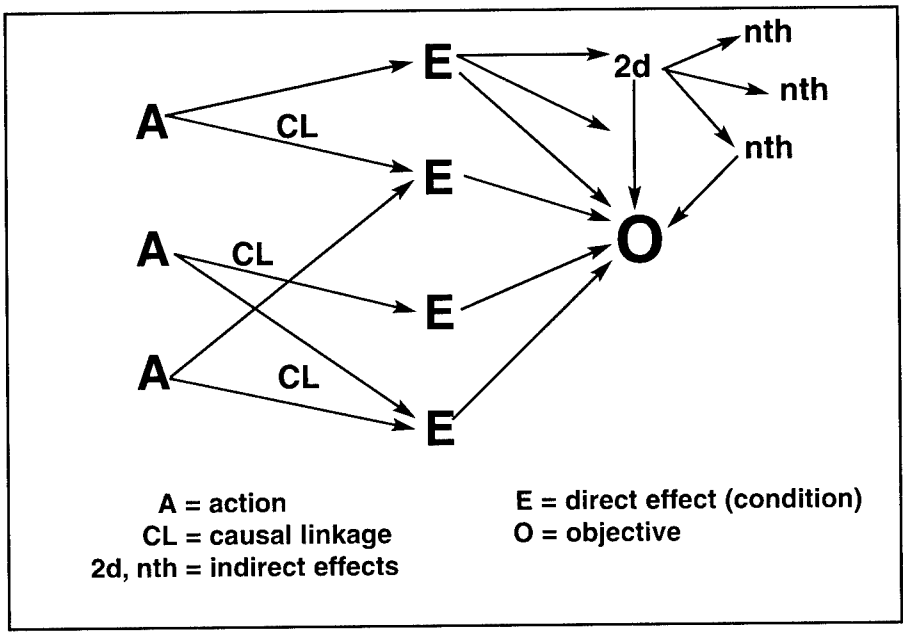


Figure 8. Relationships between Indirect Effects and Objectives

Of course, in recent years everyone has become very cognizant of collateral damage, especially as it is often shown on national television, sometimes within minutes of the action. Planners today spend enormous amounts of time reviewing targets and known weapons effects to ensure they do not unnecessarily damage civilian targets. In fact, to many people especially journalists, collateral damage has become synonymous with civilian deaths. At a deeper level of analysis, however, planners are still

prone to miss second and third order effects that do not directly result in destruction of nonmilitary targets or danger to civilians, principally because they do not look for them. The Desert Storm air campaign, a monumental intellectual effort, was brilliantly planned; yet planners completely missed the second and third order effects on the civilian populace caused by disruption of electrical power to Baghdad and other Iraqi cities. In retrospect it obviously was possible to have foreseen the closure of sewage- and water-treatment plants and hospitals, yet it would be wrong to say their oversight resulted from deliberate neglect. The current objectives-based planning paradigm simply does not prompt planners to look for this type of collateral effects. The EBO methodology moves objectives-based planning to the next level of analysis, thereby providing the necessary analytic rigor. This rigor comes more or less naturally with analysis of desired effects and the underlying causal linkages by which planned actions are expected to create the desired effects.

The EBO methodology requires an ability to deal with complex interactions and to adapt rapidly to changing conditions. Not all effects are immediately or directly connected to specific actions. The more complex the desired effect (e.g., psychological versus physical), the more difficult it may be to see the connection to precipitating actions. There is a whole array of different types of effects to deal with: direct, indirect, cascading, cumulative, and collateral (both positive and negative), just to name a few (see final section of this study for EBO terms and definitions). Effects of all types can be achieved at all levels of employment: tactical, operational, and strategic.

As already indicated, some effects will be much more difficult to measure than others. This holds true for anticipation, as well. Generally the higher order the effect (e.g., psychological versus physical) and the further removed from precipitating actions (e.g., 2d, 3d, nth order indirect effects), the more difficult it will be to anticipate and to measure. This is important to note, because the ability to anticipate the effect(s) an action will bring about and then measure to see if the anticipation was correct is critical to adaptation, and adaptation is critical to success. The eminent military historian, Michael Howard, once declared himself "tempted indeed to declare dogmatically that whatever doc-

trine the Armed Forces are working on now, they have got it wrong. I am also tempted to declare that it does not matter that they have got it wrong. What does matter is their capacity to get it right quickly when the moment arrives."[68]

In a similar vein, the EBO methodology will be more effective if actions are executed, evaluated, and adapted quickly. Getting it exactly right the first time does not hold near the promise of being able to adapt quickly, turning initial shortcomings into ultimate successes. Rather than waiting for the 80 percent solution to act, it may be necessary to execute a 40 percent or 50 percent solution, then quickly assess and rapidly adapt to the measured results. Paradoxically, a search for evidence that the plan is failing may be more productive than a search for positively reinforcing evidence. Lack of positive evidence may indicate either that the plan is failing or that insufficient time has passed to achieve the effect. Whereas, rapidly accumulating negative evidence suggests an immediate need for adaptive response.

The concept presented in this paper posits that joint forces can achieve full spectrum dominance, a macro-level military objective, by exploiting the four operational concepts outlined in *JV 2020* along with macro-level military actions to create desired effects so powerful as to dominate any situation in which the joint forces are directed to intervene. In this sense dominance is not always related to an adversary. Joint forces may be required to dominate situational or environmental conditions in many cases, especially in actions at the lower end of the spectrum of engagement.

This perspective requires a broad view of effects in all types of military action, not just selected ones. Effects-based targeting, fires and effects, and rapid decisive operations (RDO) have each been discussed at times as if they equated to EBO. However, while each of these concepts is related in one way or another to EBO—and each probably has a role to play in the larger construct—none of them comes close to the comprehensive concept required to implement the EBO methodology. Effects-based targeting, for instance, has a role to play, but effects-based movement, supply, attack, defense, and maneuver all have equivalent roles. Effects-based targeting and RDO are

likely to have little role in most HUMROs, but movement and supply will usually have major roles. Joint action of any kind must embrace the larger concept of EBO.

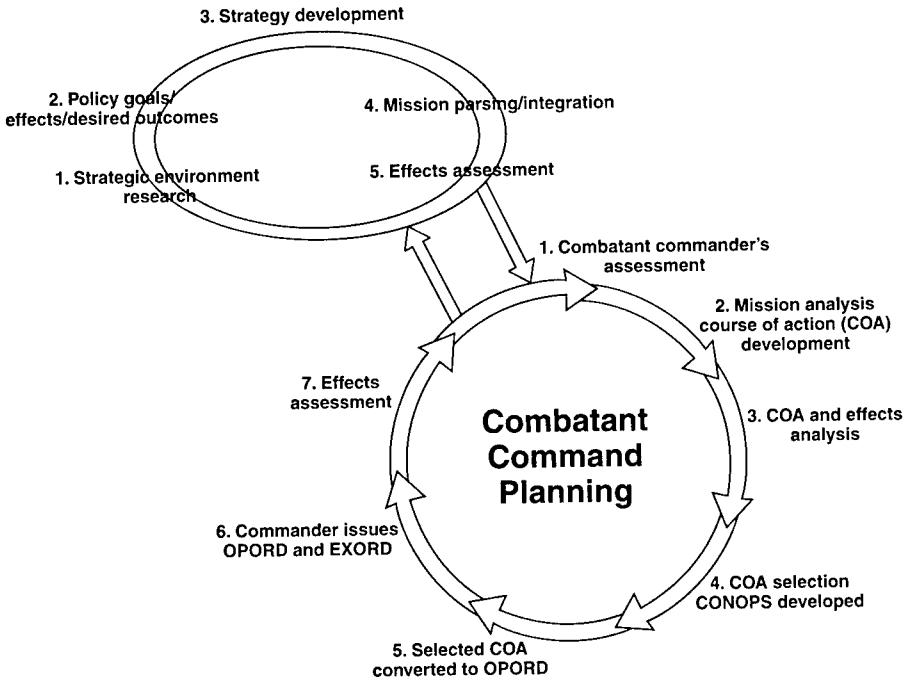
The USAF explored EBO concepts during the Air Force chief of staff sponsored-global engagement (GE) IV wargame in October 1999. According to senior game players and key overseers, EBO worked well so long as the players stayed focused on the concept. However, it broke down rapidly during actual game play, as players became focused on the mechanics of operational planning—the air tasking order (ATO) cycle in the specific case, since they were gaming joint air operations.[69] The Naval War College experience in the Navy global war games appears to be quite similar.[70] The challenge appears to be to educate and train planning personnel to stay focused upon the effects they are trying to create at each level of employment. The best way to do this is to define a process that continually fosters effects-based thinking during planning, execution, and assessment of all actions.

An Idealized Joint EBO Process

The model described here is intended to idealize the process national leaders, commanders, and planners at all levels follow in directing, planning, executing, and assessing EBO.[71] Such an idealized model of the EBO process is useful for several purposes. This model, or a further refined version of it, could provide a standard for evaluation of the joint and service planning and execution processes that are currently described in doctrine. It could also serve as the standard for revision and improvement of the currently defined processes, if revision proves necessary. This could help to appropriately modify and perhaps expand such current processes as the joint air operations planning (JAOP) process. It might also identify gaps in and between the several planning processes described in current doctrine and would almost certainly encourage effects-based thinking throughout. If it proves desirable, this idealized process could completely replace current planning processes with a single comprehensive one. This may not be necessary, it remains a possibility for the military ser-

vices to evaluate jointly. In the next few paragraphs the proposed idealized process model is first described and then explained phase by phase.[72]

Any such process must begin with a definition of national objectives. What is not so obvious, though, is that it should begin not at the advent of a crisis, as seems to be envisioned now, but well before a crisis develops. It must begin before the need for a particular action is even known, where exactly it may take place, or what its specific objectives may be. This may seem implausible at first glance, but it is in truth quite reasonable. The process is rooted in the overarching national objectives stated in the *National Security Strategy of the United States* and begins with a phase called "Strategic Environment Research."[73] Figure 9 outlines the process along with combatant commander's planning cycle.



Legend:
CONOPS—concept of operations
EXORD—execution order
OPORD—operations order

Figure 9. Effects-Based-Planning Process Model

Once a crisis actually begins to develop or the need for a specific action is known, operational planning proceeds through several additional phases.[74] The next phase is the definition of the policy goals and objectives for the overall action which, in order to develop useful measures of merit, must be defined in terms of effects which might be achievable and which will, in turn, accomplish the stated policy goals. Next is the development of a national strategy to decide which tools of diplomacy, information, military, and economics will be applied in the specific instance to achieve the identified objectives and policy goals. Once the national leadership has decided what is to be accomplished (end state) and the elements of national power to be employed, the missions must be distributed (or parsed) to the appropriate agencies such as State, Defense, Commerce, and so on. To this point in this idealized process the DOD, JCS, services, and combatant commanders all participate heavily in deliberation, but final decisions are the prerogative of the president and the secretary of defense. Once again the entire process should be viewed as continuous and iterative, with feedback coming from the tasked agencies to help assess progress toward the national-level desired effects, objectives, and goals. The combatant commanders and/or JFC control the next several phases in the process. As depicted, this part of the process proceeds from and feeds back to the national-level process.

The second cycle produces a joint operations plan, which envisions how the joint force will employ available assets, and how assessments will be developed and distributed up to the national-level process and down to subordinate levels. With missions assigned to appropriate agencies and an overall-lead agent chosen to maintain proper integration of all efforts, the military begins its own planning process as noted in by the combatant command planning cycle. Although the procedure is described in seemingly discrete phases, it should be noted that in reality all phases must be integrated, continuous, and iterative. Thus the final phase—assessment—actually continues right through and beyond the end of operations. It is something that should be going on even before specific actions begin and feeding all the way back to the strategic environment research phase. In other

words, assessment really is part of both the first phase of each of the cycles and the final phase following execution. It also goes on at all levels of employment—tactical, operational, and strategic—and, as stated before, assessment at each level informs the levels above and below.

Strategic Environment Research

US senior military leadership such as the CJCS, the JCS, and combatant commanders must be fully engaged in the policy debates that end with development of the national security strategy, as well as those that lead to specific military actions. Of course, once the combatant commander decides, good military commanders salute smartly and march; but until then they must offer candid advice and recommendations based upon their military expertise. Military commanders must be aware of, and point out to national leaders, the implications of various strategy options for potential military actions. They must be sure to understand fully what is required of the military by the strategy that national leaders define, and they must produce a national military strategy and operational plans that fully support the national strategy. Even during this process, the military must be already engaged in the really hard work of preparing for future actions, through strategic environment research.

Strategic environment research begins well before any specific crisis develops and really needs to be a national-level effort, yet one in which the military are major players. The military can go it alone here if necessary, but it will not be as effective in the long run. Strategic environment research consists of three major types of research—contextual, nodal, and assessment—that are conducted on three different levels: generic, regional, and target audience specific.

Contextual Research

In this EBO concept, contextual research is conducted to understand audiences that are potential targets of future actions and what capabilities, strengths, and weaknesses they possess. The carefully chosen phraseology—*target audiences* as opposed

to *adversaries* or *enemies*—is used because in many cases rather than trying to defeat these groups, US forces will be trying to assist them or simply avoid conflict with them while conducting military actions. This is especially true for peacetime engagement and most MOOTW, which are expected to make up the vast majority of all military actions in at least the next 15 to 20 years. The term *target audiences* is used also because not all groups the United States wishes to influence will be national groups or formal military forces, as usually conceived in the conquest paradigm. These groups may be informal soldiers of a drug cartel, a terrorist group, subnational ethnic group, or other nonnational group. In many (perhaps most) cases, there will be more than one target audience, with different US objectives pursuant to each. To Sun Tzu's admonition to know the enemy and oneself must be added friends, allies, other affected groups and, with today's immediate media, all identifiable elements of the entire global community. This is a daunting task that can never be fully completed, but there certainly is room for improvement over past efforts. This type of research must begin well before a specific action is ordered—it cannot be played as a pickup game. Failure to do this research in a timely way leads to errors like mirror imaging how economics and production were organized in Germany during World War II or misjudging how the people would react to given stimuli in Iraq during the Persian Gulf War.[75]

Generic Phase. Subjects of the first or generic phase of contextual research are the general geopolitical environment prevailing in the world, the nature of human interaction, and general human psyche. Academic disciplines like the study of international relations, law, and politics; military science and history; and, psychology, among others, apply here. Several important questions must be asked such as the following:

- What are the various methods of international problem resolution, how have they worked historically, and what does this portend in the current and emerging geopolitical environment?
- What does the history of military operations teach about effective application of military capabilities to attain political objectives? Also, what does it say about development

of future capabilities and potential innovative uses of capabilities currently or soon to be available?

- What potential problems does the current geopolitical environment suggest the United States might have to face in the five-, 10-, 15-, 20-year timeframes?
- What are the general kinds of physical, functional, systemic, and psychological effects the United States might need to create in target audiences to achieve national objectives and have military forces been able to create those kinds of effects in the past? If so, how? If not, how might they be created and how would one be able to test or experiment to determine their effectiveness and the capability to create them?

These are very wide-ranging studies that would require tapping outside expertise from universities, private and commercial think tanks, industry experts, and other similar places.

As an example, consider for a moment the concept of influencing a people's will to resist politico-military intervention. There has been a raging controversy for years between advocates of strategic bombing and others on this subject. There are those who say that bombing only strengthens the will of a people to resist, and that Germany's reaction to strategic bombardment in World War II lends credence to the point. Yet, by the end of World War II, German industry was suffering as high as 25 percent absenteeism of workers.[76] This would seem to be a reasonably strong indicator of loss of will amongst the general populace, but what impact did that have on the final outcome or on the German military's ability to conduct the war? No one really knows, although all kinds of assertions have been made. Overall, strategic attacks may produce shock that demoralizes enemy leadership, military forces, and population, thus affecting the enemy's desire to wage war. However, a demoralizing psychological impact can be an elusive objective.[77]

History has provided clear examples where military actions have affected the will of soldiers to resist, and some in which their will was unaffected by seemingly similar actions. A historical study of several of these cases indicates certain common factors in the cases where soldiers were affected that are missing in the unsuccessful attempts (such as maintaining

constant pressure on them, interdicting food supplies to make them hungry, and so on).[78] If one can reduce or destroy trained soldiers' will to resist, it stands to reason the same would be true with civil populations, who are less likely than soldiers to have the specific training and discipline necessary to withstand such efforts. The question is how, and are there any circumstances under which the how will be acceptable to domestic and foreign audiences? Conducting this kind of research certainly is not easy, but these are exactly the kind of studies needed to prepare for EBO. There are many cases where target audiences have capitulated without being completely defeated or exhausted, as well as cases where they would not capitulate until they were decisively defeated and under occupation. In many cases, even after occupation a large segment of the populace continued to resist covertly. It is important to try to understand why.

Obviously these are very complex issues. Different groups have different psyches, which includes a stronger or weaker will to resist. They hold different values for the same things. They are frightened or intimidated by different things. In fact, different groups act differently when frightened or intimidated, and the same group may act differently under differing circumstances? What common factors existed in groups that have capitulated and what differences? Are there relatively finite and predictable conditions under which capitulation occurs or has occurred in the past? It might be possible to categorize the will of a given people, and therefore the conditions under which they might capitulate in a given instance. There is no point in wasting effort trying to break their will if it cannot be done. On the other hand, in some cases it might be the only thing that is necessary and might even prove relatively easy. Generic contextual studies should help national leaders and military planners to understand these issues and what the general rules are. Given a particular psyche and mind-set in a target audience, when does it help and when does it hurt to turn off electrical power or telecommunications? Under what circumstances should intervening forces generally consider replacing a target audience's telecommunications with their own transmissions, and when should they leave well

enough alone? All these questions and many more of similar nature should be addressed during the generic contextual part of strategic environment research.

Regional Phase. Nearly every geopolitical issue has global, regional, and subregional contexts. In most cases what can and cannot be done in a given action, as well as what should and should not, will be heavily influenced by regional and subregional issues. How do nations and subnational groups interact within the region and with those from outside the region? In this realm there are cultural issues as well as geopolitical ones. How is diplomatic, economic, and social intercourse normally carried out in the region? Are decisions made by edict, consensus, or majority rule? Who are traditional friends and who adversaries, both within the region and with the United States? Is there a general psyche that can be applied? What will a particular target audience concede with token resistance, and for what, if anything, will they fight fiercely? Do they tend to enhance their capabilities through training and education, and can they organize effectively to conduct operations? These will be important aspects to consider for several reasons. In adversarial cases, US forces obviously need to know as much as possible about the answers to these questions, if they are to have any hope of creating the effects necessary to achieve national policy goals. In all cases the US military will need to understand the viewpoints, strengths and weaknesses of friends, allies, and neutrals. Information operations may be necessary to ensure friends remain friendly during military actions and neutrals remain at least neutral.

Normally during military actions some of the peoples of a region will be friendly toward the United States and US interests and some are likely to be neutral. One or more groupings may be adversarial. When contemplating a course of action it will be important to understand how each of these audiences will react. If they share common cultural or religious beliefs, some of the peoples of the region may be negatively affected by certain actions, even though they otherwise agree with the United States concerning the issues in conflict. In this case, taking the contemplated course of action will create negative collateral effects, and the United States will either need to pursue a different course of action or act to mitigate its friends'

negative reactions to the intended one. This will require expanded-regional studies to help leaders and planners understand interactions of all the parties affected by the conflict or military action. Additionally, it will be necessary to undertake target audience-specific studies to try to understand how each target audience will react to various stimuli and how to create the desired moral and mental effects among them.

Target Audience-Specific Phase. This phase addresses many of the same issues but on an individual basis to determine specific strengths and vulnerabilities of all potential target audiences. If the generic contextual research is done properly, it will reveal susceptibility of certain types of target audiences to specific types of actions. Target audience-specific contextual research will try to elucidate characteristics of each potential target audience, and those effects to which they may be susceptible. Also, it would help determine how those effects might be created in the specific target audience. Each potential target audience's susceptibility to specific effects will change over time, depending on many factors, so these analyses will require constant update. The necessary basis for this research, however, is as specific an understanding as possible of the psyche of each potential target audience. In many cases outside resources, like regional experts and historians, will need to provide the necessary detail; but it will also be necessary for the military to have numbers of personnel sufficiently trained to understand what the experts are telling them. When US forces begin a military action they must know how the target audiences are organized, how they think, who makes decisions, how they make them, what they value, who has influence, and how their culture differs from others. This will help to avoid the mistake of assuming they will react as some other group would in a given circumstance or stereotyping their potential responses in some other defective manner. It will also give a much better feel for how easy or difficult it will be to create a particular desired mental or moral effect within a particular target audience.

Nodal Research

Nodal research must be conducted in parallel with contextual research and at all the same levels, although the levels

are more closely intertwined and less distinct. Nodal research is the study of subsystems that make up a target audience and their moral and physical infrastructure. Generic studies and military experience will suggest the most interesting types of subsystems for each case. To a great extent they are already identified and similar to what was considered in the World War II industrial web and Desert Storm's system of systems approach. The nature of nodal research can be illustrated by simply continuing the previous discussion of electrical power production and distribution systems. These systems will continue to be of interest in many military actions, so it makes a convenient and useful example. US military forces will need to understand how best to attack and defend such systems.

All power distribution systems, as they exist today, have many common factors and similarities. Power-generating plants are all constructed in much the same manner (of course there are nuclear, hydro, oil, and coal powered plants); but it is not difficult to distinguish which is which, and their construction is very similar by category. Transmission systems are all constructed in very similar ways. Thus it is important to understand the basics of power generation and transmission. Power distribution systems have also become quite ubiquitous in the modern era, and are fairly redundant and interconnected, which is to say one can no longer consider most power distribution systems as discrete and/or self-sufficient. Most national power grids are now interconnected with other national systems, and power can be rerouted throughout the system whenever usage patterns change or problems occur. Thus, if military planners are going to target a system for one reason or another, it will be important for them to know who else is connected to that system and how through comprehensive regional analysis. Otherwise the planners are likely to create undesired collateral effects in neutral or friendly countries when attacking an adversary's system.

Often the desired effects will be achieved through quite discrete actions, so analysts will also need to examine each potential target system in detail. This is the traditional nodal analysis US forces have learned to do over the years. The Joint Warfare Analysis Center (JWAC) is becoming very sophisticat-

ed at this type of analysis and can now determine very accurately what a particular type of attack will do, and how to achieve very discrete physical and functional effects in a given system. Planners want to know both how to create the effects they desire and how to do it efficiently. They also want to know what else is likely to happen when they act to create the desired effects, in both the short and long term. The next step is to achieve a similar level of sophistication for systemic and psychological effects. In a HUMRO, for instance, planners may need to know how to convey the message that US forces are there to help—not to control or suppress the populace—and that when they are finished helping, they will go home. In this case the planners would need to know, among many other things, the critical nodes and links to communicate with major population elements, as well as who the important elites are that the people might listen to. Planners would also need to know what specific modalities would convey the appropriate message, without inadvertently conveying other messages detrimental to their objectives. This problem, though similar in basic construct, can prove considerably more complex than nodal analysis of an electrical power grid. JWAC and others have started work on this aspect of analysis already, but there is a long way to go before the US military possesses the full capability required to conduct EBO.

Assessment Research

The last, but certainly not least important, part of strategic environment research is assessment research. It provides the groundwork for analysis to determine how well the plan is developing in actual operations. This area probably represents the greatest planning challenge in transitioning to EBO. In the past, combat assessment, which is commonly but incorrectly referred to as BDA has been a sort of afterthought. Actually BDA is only one particular piece of the overall combat assessment process. Airmen have often asserted the ability to achieve functional, systemic, and psychological effects, which would—in turn—achieve strategic objectives in a more direct manner than ground forces. For instance, the oft-maligned Douhet espoused, as early as the 1920s, that the advent of air-

power had completely changed the nature of warfare by shifting the focus from ground to air actions. He thought that heavily armed strategic bombardment aircraft, which he called battleplanes, would be able to directly attack and break the will of a people to resist, while ground forces were still mobilizing and before they could move to the frontier to attack enemy forces. Thus a political settlement would be forced before surface forces even engaged.[79]

While the Army Air Corps Air War Plans Division (AWPD)-1 document planners eschewed Douhet's concept of direct attack on the civilian populace, they thought that airpower alone could win World War II through strategic attack on the industrial web. Such an attack, they believed, would break both the capability and will of enemy nations to resist. This proved more difficult than predicted. After much debate, the Allies finally agreed to conduct direct attack against civilians as part of the CBO. Under this agreement US strategic bombers would attack industrial plants and storage facilities in the daytime while British bombers would attack adjoining city areas at night, in hopes this would degrade the morale of the people by keeping them under constant day and night pressure.[80]

Once again in Desert Storm, air planners intending to create strategic paralysis through systemic attack included attack on the will of the people as part of their plan. This time, however, no physical attacks were deliberately directed against civilians. The planners hoped instead—by disruption of electrical power, petroleum products, and transportation combined with a strategic psychological campaign—to induce the people to turn against their leader, Saddam Hussein. The strategic psychological campaign never developed, however, apparently due to lack of clearly designated responsibility for mounting such a campaign and resultant wrangling within the interagency community.[81] Whether or not such a campaign would have made a difference in the outcome is still a matter of debate.

In both World War II and Desert Storm cases, US forces were less than satisfactorily prepared to assess their level of effectiveness, especially as related to systemic or psychological effects. The intelligence analysis system even had great difficulty delivering physical and functional-damage assessments in

time to be useful to planners.[82] Years after the conflict, effectiveness of systemic and psychological effects assessment remains more a matter of debate than scientific study.[83] What really happens is that levels of physical destruction are measured, and then a level of functional effectiveness is determined based upon the percent of the facility destroyed. This is what current combat analysis methodology is designed to do.[84]

Combat-assessment capability needs to be improved, but the entire conceptualization of assessment must also be expanded to include effects assessment at all levels of employment and across the spectrum of engagement. Not all actions include combat, but all actions can be related to effects planners desire to create as well as effects they desire not to create. The concept of effects assessment, as contrasted to combat assessment, connotes this broader perspective. Combat assessors must learn to measure functional, systemic, and psychological effectiveness with much greater accuracy and fidelity. This includes a need for functional, systemic, and psychological effectiveness models and simulations which will help planners and assessors both to better understand how to create a particular effect and to determine whether they are succeeding in a specific instance. Effects assessment research must look for discrete indicators that will tell—with a significant level of fidelity based on appropriate analysis, modeling, and simulation—whether actions are moving toward achieving objectives or not. These indicators will have to be things US forces and intelligence agencies have the capability to detect and that, at the same time, do not lend themselves to easy deception. One example, with respect to a physical effect, would be measuring the distinctive infrared signature in a generating plant that indicates the level of power being generated and transmitted. In this way, it is possible to measure power generation levels with high fidelity. It is also very hard to mimic with sufficient accuracy to spoof properly trained analysts.

At the generic level analysts will need to know, in general, what kind of indicators can be useful for determining progress toward or achievement of particular effects—including the full range of physical, functional, systemic, and psychological—and how such indicators can be collected. Collection systems

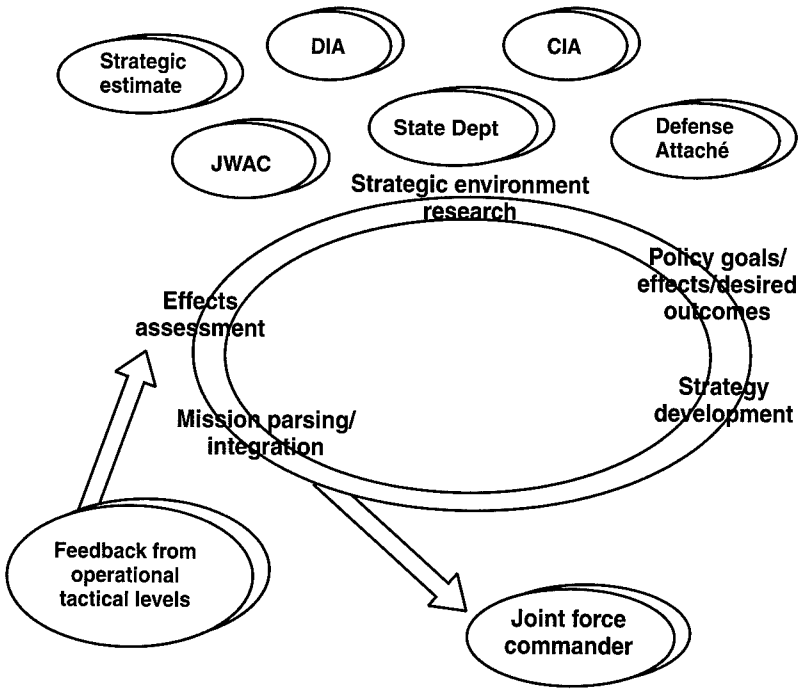
will have to be redesigned to quickly and efficiently gather the type of information identified in this analysis. The assessment system itself will need to be redesigned to more fully assess functional, systemic, and psychological effects. This is going to be a real challenge. In most cases physical and functional effects will be quite generic and continue to be easier to determine than systemic or psychological effects. Assessment of damage to a power production plant will look similar wherever the plant is located, and the functional effect produced by a given physical result will be relatively standard. Multi-spectral sensing and algorithmic models will be very useful for these kinds of analyses.

Systemic and psychological effects are not so standard or easy. These particular effects will vary greatly from one region and target audience to another. Regional and cultural studies will be required to predict and analyze these types of effects with any level of accuracy. A lot of this preparation can be done in conjunction with the other studies already mentioned under strategic environment research by keeping one eye specifically attuned to potential assessment measurements for the various effects studied. This particular problem is part and parcel of one of the greatest challenges to fully adopting EBO. If the problem of predicting and assessing systemic and psychological outcomes with reasonable fidelity cannot be solved, EBO will lose much of its value for US military forces.

Determination of National Policy Goals and Desired Strategic Effects

Basic national security objectives are established in the national security strategy and the ensuing military objectives in the national military strategy. When a crisis develops or peacetime actions are necessary to avoid one, the president and secretary of defense develop national policy goals and desired outcomes for the actions. The policy goals define the end state desired and the specific objectives for the anticipated actions. Often this does not happen smoothly, however, and the military finds itself needing to develop operational objectives and brief them back to the national leadership. In the case of EBO

the objectives should specify the effects the United States intends to create to accomplish the stated policy goals (fig.10).



Legend:
CIA—Central Intelligence Agency
DIA—Defense Intelligence Agency
JWAC—Joint Warfare Analysis Center

Figure 10. Detail of National-Level Process

By way of example, the United States may support a national security strategy objective to encourage growth of democracies. In a hypothetical example, the United States might wish to support a struggling democratic government in a nation that is experiencing civil unrest in the wake of a natural disaster. A relevant policy goal would be to bolster the government by providing support to alleviate the effects of the natural disaster and thereby help quell the unrest. One desired effect to achieve such a policy goal could be phrased as "stop the starvation and outbreak of disease caused by the

natural disaster." One of the military's roles in achieving this goal could be to provide sufficient foodstuffs and medical supplies to maintain a satisfactory level of health and welfare for the entire nation. Ensuring the distribution of the food and medical supplies to remote regions of the country would require the employment of substantial airlift forces. In such a potentially volatile situation, another desired effect should be to diffuse civil unrest fostered or encouraged by the crisis.[85] There will always be a number of possible means to achieve desired effects ranging from direct, massive intervention all the way down to simply providing supportive friendship, advice, and/or monetary assistance. During this phase of planning, planners are not overly concerned with deciding how to achieve the effects, except for a cursory review of feasibility. The actual decision as to which means to pursue comes in the next phase, strategy development.

Strategy Development

One of the commonly used definitions of strategy is "relating means to ends," which constitutes the principal thrust of this specific phase in planning for EBO. There will be a number of possible approaches to achieving the desired effects in the example introduced above. At the high end, the United States could insert a major military force, declare martial law, and take over management of the situation on behalf of the foreign government until such time as it is ready to reassume control on its own. At the low end, the US government could simply state its faith and confidence in the foreign government and urge the people to give it a chance to handle the situation on its own. In between is a wide range of possibilities including but not limited to those outlined below:

- Generate sufficient airlift to bring in foodstuffs and medical supplies donated by the United States and coalition partners.
- Undertake internal distribution of food and supplies by either the host government or the United States depending on the situation.

- Encourage nongovernmental organizations (NGO) to provide and/or distribute the necessary supplies.
- Provide financial support to either the host-nation government or the NGOs for them to procure and distribute supplies.
- Support host-nation internal security with counterinsurgency or other military forces as required.
- Encourage and advise the indigenous government as requested.
- Provide on-scene advisors to deal with the insurgency and civil unrest issues.

Which strategy or strategies the United States chooses will be based upon strategic environment research, analysis of the current situation, and what each suggests as the best alternative for the desired end state.

In strategy development, planners and analysts build a comprehensive list of the range of possibilities and determine which combination of actions is most likely to create the desired effects and achieve policy goals. Next they would compare capabilities to the range of strategy options based upon the current situation and what is already known about the host-nation's situation from strategic environment research. This process is complicated by the fact that policy goals are likely to include some less explicit, yet nonetheless equally important, aspects than those outlined above. Considerations such as a desire for few or no casualties and a reasonable limit to the overall cost of the action must be taken into account. For each possible strategy, these costs must be balanced against both the probability of achieving policy goals and the valuation of those goals. For instance, the US government and people are willing to pay higher cost for national survival than they are to ensure humanitarian treatment of a foreign national minority group. Strategy options must also be measured against the capability to accomplish them successfully, and the possibility that execution of these same options may create undesired collateral effects. There will be a large number of considerations unique to each case, but the ability to deal with them is enhanced by results of strategic environment research.

Mission Parsing and Integration

Once a national strategy for implementing policy goals is established, missions must be assigned to the appropriate agencies, an overall-lead agency should be determined, and the actions of the various agencies integrated. This raises a point that will be one of the great challenges to US policy of the twenty-first century or at least the early decades of the century until it is solved. US military forces have struggled for many years to achieve a satisfactory level of jointness within and between the respective services. However, for all the challenge that military integration has been, the question of "interagency-ness" has all the appearance of being yet much greater. In the current geopolitical environment, US military forces will rarely be engaged in strictly military actions in pursuit of national-policy goals. Most of the time military actions will have to be integrated with those of other governmental and nongovernmental agencies. The military will not be acting independently, as normally has been assumed under the conquest paradigm. Instead, they will nearly always be operating alongside departments of State, Justice, Treasury, law enforcement, other agencies and, when warranted, NGOs. Unless and until the interagency process is rationalized, it will often be unclear who is in charge in such cases. The key point here is that it will be necessary to determine which agency has primary responsibility for which portions of the action, and, preferably, which has overall leadership responsibility for the entire action.

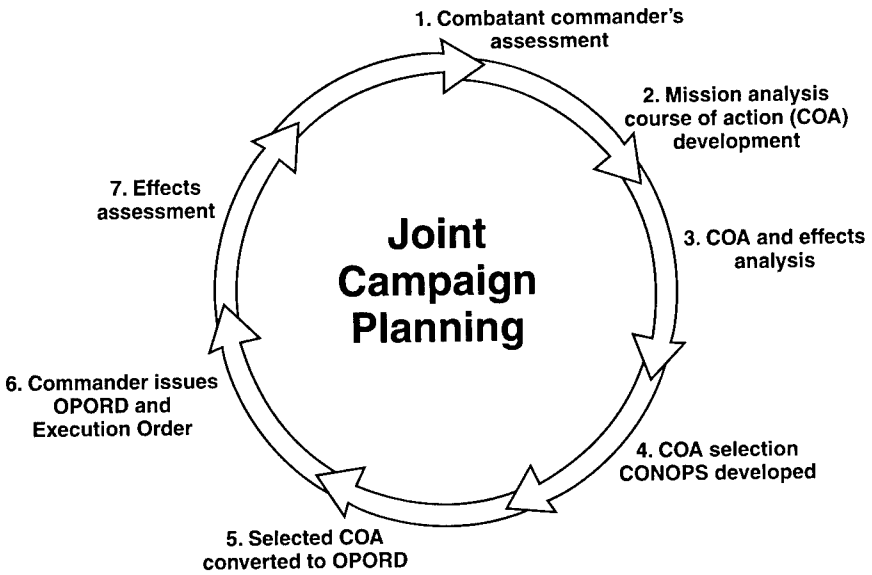
In the example of the democratic nation experiencing civil unrest following a natural disaster, it is highly probable that the State Department would be given overall responsibility for the action. Specifically, the State Department would coordinate US participation in the natural disaster relief operations with the Defense Department providing logistical and other types of support.[86] The Defense Department arguably would be in charge of counterinsurgency operations, either to provide counterinsurgent forces or the appropriate equipment and advice to the host nation. The Justice Department might be called upon to advise and support the local government with law enforcement and judicial procedure. The department in charge might change over time, depending on which of the pol-

icy goals and desired effects requires the predominant effort and the approach chosen. In any event, the missions would ideally be assigned to the agency or agencies with the most appropriate capabilities, concomitant with the overall strategy for the action to achieve the desired effects. Inherent in all these actions is the need to fully integrate wide-ranging, disparate but clearly linked actions to achieve maximum leverage and avoid "objective fratricide." This is to say that without deliberate, careful integration, various actions may conflict with one another and negate the very effects the United States is trying to create in pursuit of policy goals and objectives. By integrating and carefully considering the interaction of various actions, US agencies can not only avoid the potential negative collateral effects of uncoordinated actions but also more clearly focus the full range of resources available to achieve national policy goals.

Effects Assessment

As agency actions proceed, effects assessment must provide feedback to the overall process so that strategic-effects assessment of national-policy goals may proceed and the national-level process can continue to cycle as was shown in figure 10. Effects assessment is specifically discussed later as a part of the joint planning and execution cycle. For now, suffice it to say that all agencies must feed appropriate effects assessments back into the national process to properly inform national decision makers, so they may determine if national policy goals are being met and whether the goals may need to be adjusted based upon the new information and/or changing circumstances.

The process to this point has been a national effort in which the military does not and should not have the lead decision-making role. They should, however, be equally represented and participate with other agencies in reaching this point. Once missions are assigned to the agencies and groundwork laid for integrating their missions, each individual agency begins its own planning and action cycles. The joint planning and execution process is idealized in the cycle depicted in figure 11.



Legend:
CONOPS—concept of operations
OPORD—operation/operational order

Figure 11. Joint Campaign-Level Process Cycle

Agency-Level Process

With missions assigned to appropriate agencies and an overall-lead agent chosen to maintain proper integration of all efforts, the military begins its own planning process as depicted by the Joint Campaign Planning Cycle in figure 11. With the exception of an overt emphasis on effects, the depicted process follows a model very similar to the Estimate process outlined as appendix B in JP 3-0 and the Collaborative Planning at Combatant Command process covered in JP 5-00.2, *Joint Task Force Plans and Policy.* Additionally, the idealized functional planning process is readily adaptable to the JAOP process as described in JP 3-56.1, *Command and Control for Joint Air Operations* (to be redesignated JP 3-30). The EBO methodology will require tight linkages in planning, execution, and analysis cycles from the national down to the tactical level. Component, joint, interagency, and coalition actions must be fully integrated to produce desired effects and to

assess progress toward creating the conditions necessary to achieve national-policy goals. Planning cells must be integrated at each level to produce a unified, interactive, anticipatory assessment, planning, execution, and effects analysis team. Any "stovepipe" organizational walls that currently exist must be broken down to facilitate effects integration at each planning level, focused by the vision of the commander at that level.

Execution

With the proliferation of mobile targets and the expansion of efforts to carry out direct strategic actions, it is becoming ever more imperative to conduct continuous, iterative planning. In more ways than ever before, executing forces provide the immediate feedback of direct or first order effects necessary to plan the next cycle of actions. Cockpit videotapes, for instance, are becoming a necessary postaction-assessment tool to judge immediate, direct effects. The assessment of direct effects is imperative to the determination of an overall effects assessment. The tempo of operations is becoming so rapid that, in the very near future, replanning may begin within minutes of initial execution.[87] Executing forces will become more and more part of the immediate planning process, as well as the immediate and continuous effects assessment phase, which will be necessary for success of EBO.

Assessment

As already mentioned several times, assessment should be thought of as the beginning, middle, and end of the entire planning, execution, and assessment cycle. Assessment, or at least planning for assessment, begins long before an individual action is even envisioned and continues long after it is complete. It is critical that assessment is conducted at all levels of employment—strategic through tactical—and that it is directly related to the effects desired at each level. To support EBO, effects assessment will have to be much more comprehensive and complete than the current CA process. Currently CA assesses physical damage to a target or objective, the functional effect of the damage, and weapons effectiveness based

on the physical and functional effect. This assessment is, of course, necessary, but what it does not do is even attempt to assess systemic or psychological effects. To make EBO work it will be necessary to assess these higher-level effects with a reasonable level of fidelity.

Effects assessment must continuously feed back to the military planning cycle, beginning with phase one, combatant commander's assessment, to inform the operations planning process. It must also feed back on a more occasional basis to the national planning level so decision makers can see how actions are developing relative to national objectives and whether some or all of those objectives might need to be altered. This also provides an opportunity to evaluate whether some of those objectives may have changed for other reasons. To emphasize once more, the entire process is continuous and iterative and each phase must be constantly informed by all the other phases. The discussion of the process ends here, but the process itself never ends.

Summary: The EBO Methodology and Process

In preparing for warfare or contingency actions, planners must carefully examine the scenario and relevant circumstances to determine the effects required for achieving the objectives established by the national leadership. The main challenge now facing US defense planners is to consolidate recent and planned future improvements in "battle space" awareness, C^2, stealth capability, rapid global mobility, and the capacity for precision engagement into the foundation for an effects-based approach across the spectrum of military operations.[88]

An additional challenge for joint forces is to start any contingency with the ability to understand the situation fully and define the desired effects that will achieve national policy goals. If the contingency involves a real or potential adversary, then it is critical to manipulate the adversary's threat potential, reduce his offensive and defensive options, limit his unpredictability, influence his will and perspectives, and constrain his actions so that they can be recognized and exploited. The onus is on the JFC to successfully orient a wide array of military and nonmilitary actions toward a set of common objectives.

The EBO methodology requires greatly expanded knowledge of potential target audiences including a well-developed understanding of the strategic environment background as a preliminary phase. Subsequent phases include the determination of objectives and by extension desired effects to achieve those objectives. It is paramount that the military forces, and others involved, be prepared to respond rapidly to a wide variety of crises and apply all available lethal and nonlethal capabilities as appropriate. It is equally important that they be prepared to fully assess the resultant outcomes and provide requisite feedback to evaluate progress toward the JFC's objectives and current strategy. Applied properly, EBO can achieve results out of proportion to the amount of military force applied. There are some very serious considerations in preparing to move in this direction, however, which are discussed in the next section.

What Are the Major Challenges in Implementing the EBO Methodology?

Implementing the EBO methodology, as described in this study, will not be an easy task. For all of the past efforts to orient on effects rather than destruction, actually moving to consistent effects-based thinking will require a culture change within the military forces. This undertaking is likely to prove daunting and contentious, and building the new culture will take many years. As previously mentioned, in the Air Force's GE IV war game, senior mentors and other participants found that EBO was very effective when planners stayed focused on it. Unfortunately, it appeared difficult for them to remain focused due primarily to their unfamiliarity with effects-based thinking and processes. As a result, most players fell into the pitfall of reverting to their previous war-gaming or operational experiences and got bogged down in the routines of the AOC. Many became mired in the tactical-level targeting cycle and forgot to seriously consider the higher-level desired effects that GE IV planners had intended as their focus. Instead of effectively commanding air and space power to attain desired effects, war gamers found themselves managing the ATO to service targets.[89] The Headquarters USAF initial report titled *The Air War over Serbia* stated a similar

situation occurred in the combined AOC at Vicenza, Italy, during the 78-day air campaign in 1999. While air commanders were attempting to execute an effects-based targeting campaign, it more closely resembled a servicing of target lists. The result was similar, as commanders found themselves concentrating primarily on the ATO rather than the effective employment of air and space power.[90]

The second pitfall observed during GE IV was a tendency to focus on the input part of the process rather than output. Specifically, members concentrated on data such as numbers of weapons systems, weapons of a certain type, sortie count, and amounts of ordnance available and expended, almost to the exclusion of other important considerations. Consequently, far too little emphasis was placed on the output part of the process, which was concerned with achieving the stated objectives. In particular, the functional, systemic, and psychological effects—which were deemed important at the outset of the war game—basically were disregarded during the game.[91] If GE IV is any indicator, there are some very significant challenges to overcome, especially in the education and training associated with EBO. Although the challenges are substantial, the potential benefits are enormous, if an effects-based approach to military operations is adopted.

With the aforementioned problems as a starting point, the authors recognize two major areas of challenge in fully implementing the EBO methodology. The first is modifying both service and joint doctrine to fully articulate what can be accomplished with EBO. Second, there are major issues in the area of C^2 that must be addressed. C^2 represents perhaps the greatest of the three challenges discussed here, since effective C^2 for EBO depends on how both intelligence analysis and combat assessment not only are performed but integrated into the planning process. In the remainder of this section, each of these issues will be addressed more fully.

Military Doctrine for EBO

From what has been stated to this point, it should be fairly obvious that one of the first orders of business is to agree upon a definition of the process for effects-based planning and incorpo-

rate this process into formal service and joint doctrine. In a similar fashion following the Gulf War, the air campaign planning process used by the air planners became part of joint doctrine. This five-stage air campaign planning process, now known as the JAOP process, was refined and became the centerpiece of JP 3-56.1. Just as it was with the JAOP, it does not matter if the EBO methodology is articulated precisely as presented herein. The important matter is the development of a comprehensive effects-based concept that can be agreed upon and implemented jointly. One of the potential criticisms of this proposal is that the full utility of the EBO methodology is heavily dependent upon national level and interagency support. The criticism correctly asserts that is there is no way to ensure the support of these agencies. However, significant benefits can still be realized even if full national level and interagency support is not secured from the outset. The military as a whole will profit even if it must incorporate the EBO methodology unilaterally, as almost certainly it must. Hopefully as the dividends from the EBO methodology are realized, other agencies will become more and more supportive over time.

The next, and closely related, part of this challenge is to define effects-based terminology. The military services and the joint staff have been talking a great deal about EBO in recent years. This is one of the key reasons it is the right time for the US military to adopt effects-based thinking. Nevertheless, it is apparent that when EBO is discussed, all participants do not share the same understanding. For example, much of what has been put forth to this point from the Army has revolved around a concept called fires and effects. In this context EBO takes on a very narrow definition of the effects of fires in support of maneuver. This Army perspective does not address other areas where effects are important, such as the effects created by maneuver. Almost directly opposed to this view is the one that equates EBO only with the results of operations other than those associated with traditional fires and maneuver. Such effects may be achieved through information operations and/or the use of nonlethal weapons among a host of other possibilities. Others have defined EBO wholly in terms of "disabling a target using lethal and nonlethal means while keeping collateral damage to an absolute mini-

mum."[92] Suffice it to say that there is a plethora of ideas and concepts surrounding EBO. Perhaps the closest parallel of all the services to what is being proposed herein is the Navy's developing concept of EBO and network-centric warfare, which is very similar to emerging Air Force and joint views of EBO and information warfare. There are more perspectives, however, and experience suggests that those who understand best what is contained in this study regarding EBO readily admit that no one fully understands the concept yet. Clearly defining effects-based terminology can go far in establishing a mutual understanding.

A key step in implementing any EBO concept, then, would be to get all the services and the joint community to agree on usage of the relevant terms. Current USAF doctrine is laced with effects terminology; and there are relatively frequent references to effects in sister-service and joint doctrine, but nowhere is the term *effect* even defined in any joint or service doctrine document. Clearly, as a foundation, it is necessary to define effect specifically and carefully describe how it relates to the concept of EBO. With that as a starting point, there are other terms that almost certainly need some joint definition, if a common EBO language is to become a reality. For instance, USAF doctrine defines the terms *strategic effect* but not *operational* or *tactical effect*. Besides strategic, operational, and tactical effects, various publications have used terms such as *cascading, collateral, direct, indirect, intentional,* and *unintentional effects* to describe specific aspects concerning the effects-based concept. There are almost certainly other terms to be defined as well. To help in that process a lexicon of pertinent terms and recommended joint definitions has already been presented. Following this final section of the study, terms and definitions are presented for the readers' review.

Education and Training

Implementing the EBO methodology will require learning a new mind-set from the ground up. Certainly, commanders and planners should be the absolute and unquestioned experts in military art and science. Expertise will have to cross multiple domains, such as, military art and science plus politics, socioeconomics, culture, finance, psychology, physical science,

and diplomacy, to name a few. While the primary focus must remain on military art and science, it also is important to know at least enough about each of the other domains to reach out into the various disciplines, find the necessary facts and knowledge, and apply them to actions that will create the desired effects to achieve national policy goals. The US military will have to grow the right kind of specific and general expertise in future leaders from the moment they enter service through the time they become operational planners until they are ready to be component commanders, JFCs, and combatant commanders. Military leaders will then be prepared to appropriately advise national leadership on these issues, as well as to direct appropriate military operations in support of the national policy goals. Therefore, the EBO methodology requires a new way of thinking. To consistently instill such a mind-set in everyone, all professional military and continuing education must incorporate the EBO methodology.

The Air Force is taking action regarding developing officers with a much broader background in military operations through the Force Development initiative. In late 1999 Air Force Secretary F. Whitten Peters and Air Force Chief of Staff Michael E. Ryan commissioned the Force Development (then called Developing Aerospace Leaders) study, under direction of Maj Gen Charles Link, USAF, retired, to consider ways to improve the development of war-fighting skills within the USAF officer corps. Secretary Peters and General Ryan felt that officers needed a broader education in concepts of air and space power employment and general war fighting than currently was provided by the Air Force. While the Air Force had always expended sizable resources training officers for their particular career specialties, not a great deal was spent on educating them in operational art, military strategy, and the art and science of warfare. Although these are the areas of military study needed by those who might ultimately become war-fighting commanders, the Air Force had traditionally left this kind of education to chance and the initiative of the individual officer. Many Air Force officers knew only what they had learned on the job. Certain post–Gulf War studies support the contention that senior Air Force officers were not as schooled as their

Army counterparts in the application of military power.[93] The purpose of the Force Development is to initiate a program that ensures subsequent generations of Air Force leaders have the opportunity and incentive to develop a much broader background along with their specialties. What is envisioned appears to be the very kind of background necessary to plan and direct EBO. This part of fully implementing the EBO methodology will take perhaps as much as 20 years to fully complete, as a new generation of officers is brought through the educational and training system and into positions of leadership. In the meantime, today's Air Force leaders will have to work hard and incorporate these ideas and concepts into future war games, exercises, operations, and campaigns.

The Air Force has also already begun to address another aspect of this educational challenge in initiating what is colloquially referred to as the "AOC as a weapon system." In the past, training and education has been conducted in a wide variety of specialties, but it has not encompassed the work performed in an AOC, per se. Most importantly, Air Force personnel have not been sufficiently educated and trained to understand how all the areas within an AOC are interrelated. In such cases as Operations Desert Storm, Northern and Southern Watch, and NATO's Operation Allied Force, very good people were selected to work in the AOCs. Unfortunately, most of them had never been in an AOC before. There was no standard configuration for AOCs for that matter, so almost everyone was learning from scratch both how the AOC was configured and what their individual job was. This situation gave a shaky start to operations planning and control.

Air and space power has become an increasingly powerful tool for the nation. However, to achieve the full potential of air and space power, especially in the many and varied operations undertaken recently, it must be centrally controlled. The AOC is at the very heart of operations planning and execution. Moreover, the AOC has become as important in achieving national and military objectives as weapons systems and fighting units operating in the battle space itself. It is logical to educate and train the people who will work in AOCs as thoroughly as those who operate complex weapons systems. In this sense

and for this purpose, the Air Force is now treating the AOC as a weapon system itself and training a full complement of AOC personnel to operate this weapon system. The other services may want to consider adopting similar programs to develop operations center "specialists" for future military actions.

As noted earlier in the discussion concerning GE IV war game, personnel invariably will rely on their training; therefore, the EBO methodology must be incorporated into the training regimens of the services and joint staff. The need to rapidly cycle through anticipatory assessment, planning, execution, and effects analysis means Joint Task Force and Component Operations Center personnel, for example, must be very carefully trained for that specific role. Moreover, these personnel must be able to understand the integration of the various roles within the component or functional operations center. To work effectively they must be trained in system (facilities, equipment, linkages) capabilities and limitations, as well as the EBO methodology, prior to experiments, exercises, and war games.

Command and Control of EBO

As used here, C^2 refers to all the resources and systems a commander requires to be properly informed, to make and direct implementation of appropriate decisions, and to fully assess results of operations. In an attempt to be all-inclusive, C^2 is sometimes referred to as command, control, communications, and computers intelligence (C^4I), C^4ISR, or in other ways; but for the sake of simplicity, the authors use C^2 to encompass the entire system and associated processes. The area of C^2 offers much promise in helping implement the EBO methodology. Many of the difficulties experienced in past attempts to employ effects-based thinking resulted from inability to observe and analyze the outcomes of actions, especially at the more esoteric levels of the effects hierarchy. Current and pending advances in C^2—particularly in the areas of ISR and intelligence fusion—are improving capabilities to observe, detect, analyze, and disseminate exactly the kind of information necessary to EBO. One of the challenges for implementation will be buying, sustaining, and organizing the necessary resources, and training and educating the people to exploit

these possibilities. It will take some time to get this right; but if it is done right, the payoff will be huge.

The next challenge in this area for the military services is to develop commanders and staff officers who can think in effects-based terms and remain focused on the broad perspective of EBO. In particular, it is imperative for planners, operators, and assessors to develop synergistic ways of thinking about the optimum employment of military power and in this specific case, air and space power. Instead of having separate cells in AOCs for intelligence, operations, and space among others, a more generalist view needs to be adopted. For instance, rather than having intelligence collectors and analysts working in their own cell and reporting to the planning staff, they need to work side by side with operators and have an overall understanding of operations in addition to their particular area of expertise. At the same time, operations experts require a better understanding of intelligence processes and products. The same is true for all the other specialists that are gathered together in military operations centers today.

This point is critical to success with EBO because the entire cycle of operations planning and execution must be fully connected. Intelligence analysts can contribute much by determining what physical and perhaps functional effects have been created by operations. However, there is no way for these analysts to determine the systemic effects and their impact on overall capability and psyche of a target audience unless they also fully understand the objectives and intent of operations and how they are unfolding. An effective approach to EBO requires a team of experts and individual specialties with a complete awareness of the objectives and intent of operations. Comprehensive education and training—combined with a familiarity regarding the commanders' intent and desired effects—is necessary to assess whether the military is proceeding toward its goals and what alterations to the plan may be necessary. It takes this same kind of team effort to perceive subtle changes in policy goals, which sometimes occur during operations. A shift in policy goals, even a slight one, can make a perfectly reasoned EBO plan inappropriate to the new situation. It often takes careful and informed assessment on the

part of operations planners to perceive these subtle changes and their impact.

The most vital C^2 challenge in implementing the EBO methodology is the intelligence cycle. A commander needs as concise, accurate, timely, and complete information as possible to make operational decisions and to assess the results of operations. As already established, two of the most serious shortfalls in past attempts at EBO have been the ability to collect and analyze information on results of operations and the ability to determine what effects the operations have achieved. The current doctrinal concept of intelligence preparation of the battle space partially addresses the first issue but does not go far enough. Intelligence preparation of the battle space is quite obviously born of the conquest paradigm and assumes all operations can be defined as battle. What is lacking is intelligence preparation for HUMRO, peacekeeping operations or, for that matter, peacetime engagement. Preparation of the battle space assumes knowledge of where and when a military action is planned and what its ultimate ends are. As pointed out previously, by the time an operation is initiated, in many instances it is already too late for the basic background research necessary for EBO. The EBO methodology requires much preparation prior to crisis action planning, and it is incorrect to assume all actions will be combat.

Just as operations planners and commanders will have to broaden their views, so will intelligence collectors and analysts. They will have to become concerned with much broader issues than tracking target lists, defining weapons effects, and assessing physical and functional effects of combat operations. Target audiences may be viewed as a system of systems, and it is vital to predict and assess systemic and psychological effects, as well as physical and functional effects. Obviously, intelligence analysts working alone cannot accomplish all of these functions. To achieve success at these higher levels of analysis, intelligence analysts will have to be more fully integrated with operations planners. Together they will have to understand how the higher-level effects can be achieved and measured. This means a great deal of study for all participants, beginning long before specific operations are envi-

sioned. They will all have to be familiar with the pertinent information from strategic environment research and be able to apply this information during operational environment research to plan operations that will achieve the effects desired by senior commanders.

Modeling and Simulation

Another doctrine, organization, training, materiel, leadership, personnel, and facilities implication is the requirement for enhanced modeling and simulation (M&S) tools to support the EBO methodology. Most current tools—such as tactical warfare, corps battle simulation, air warfare simulation, and joint theater-level simulation—are based on algorithmic attrition models, which cannot model the higher-order effects that are critical to this methodology. In terms of supporting EBO, there are two basic aspects to M&S. First are physical systems and their interconnections (e.g., water, electricity, and transportation). As we study and learn to better understand these types of systems and interconnections, algorithmic M&S tools will also become more sophisticated and allow modeling of functional and systemic effects with satisfactory precision. For those systems where human decision makers play key roles (e.g., national leadership and military C^2), a fundamental change in approach to M&S is necessary. Some help appears to be on the way with new M&S concepts like "agent-based modeling," which incorporates "synthetic human" intervention within the model. No matter how sophisticated M&S becomes, there is no time in the near future when it can be expected to accurately model complex strategic or psychological effects. Modeling such complex effects will require development of nonalgorithmic models, incorporating human judgment for some applications. It will also require great reliance on operational art and the professional judgment of senior operational leaders. M&S technology can provide some answers if it is properly focused and centrally managed to attack the problems of effects simulation and analysis.

In fact, technology in general, is a principal enabler of the EBO methodology. In the past, attempts to apply the EBO methodology to national security concerns were severely limited by avail-

able technologies. The strategic air operations of World War II, for example, were limited by the ability to find valid strategic targets, achieve desired effects against them, and measure the results. Technological improvements made such an approach much more feasible by the time of Operation Desert Storm, but there were still major problems with anticipatory assessment and high-order analysis. Properly applied today's technologies and those just coming on the horizon will reduce the technical challenges dramatically. Stealth, precision, unmanned aerial vehicles, improved munitions, multispectral sensors, improved C^2 systems, focused and fused ISR, and other technologies can solve many of the past inhibitors. Application of the EBO methodology is within grasp, if embraced and instilled as an institutional mind-set. Although technological progress will continue to enable critical aspects of EBO, the institutionalized mind-set of the commanders, planners, operators, and assessors employing the technology is the most important factor in implementing the EBO methodology. This new approach must be instilled in personnel of all the services from their very earliest days of service.

Obviously the challenges presented here do not exhaust the full range of those that must be solved to implement the EBO methodology in the US military, but they provide a good starting point. Such challenges may never be fully solved, however, initiating the fundamentals of an effects-based approach is a huge step in the right direction. Such a step will pave the way to a new paradigm in military operations—one better suited to the uncertain world of the twenty-first century than the old paradigm of conquest.

Conclusions

Though promising, implementing the EBO methodology will not be easy. Perhaps most challenging are the needs for anticipatory assessment and high-order analysis. Many will demand perfect anticipatory assessment and high-order analysis, while some will declare them impossible because they cannot be done perfectly. Both positions proceed from a grain of truth. The EBO methodology is vitally dependent upon these two functions, and

they will never be done perfectly. In fact, just doing them reasonably well will be a significant challenge requiring extensive conceptual development, years of education and training, reorganization of many planning and assessment functions, and development and application of advanced technologies of many kinds. However, the question is not, Can it be done perfectly? The EBO methodology must be evaluated on its promise to provide greater success in employing the instruments of national power to achieve national objectives and policy goals. Nothing can ever completely remove what Carl von Clausewitz termed the fog and friction that surrounds and enfolds all political action, perhaps especially warfare. There are too many variables and such activities always involve numbers of thinking, adaptive human organizations. The problem would seem to be outthinking and out-adapting competing organizations. Properly applied, the EBO methodology offers tremendous promise for helping to solve this problem.

Notes

1. The term *spectrum of engagement* is used throughout this study to describe the continuum of peacetime through conflict to war and back to peacetime. The term *spectrum of conflict* in other writings is sometimes used, but a more neutral term is used in this study to move away from conquest paradigm thinking.

2. Military planners often seem most comfortable talking about what they will do in a given scenario: how many airplanes of what type will they send, what and how many weapons will they employ, how many sorties will be flown against which targets or target sets, and so on. It is sometimes difficult to get them to focus on what all this will accomplish, that is, what outcomes will be achieved by all this input.

3. The other branches of the US armed services are pursuing efforts along parallel lines, but the authors are more qualified to examine the USAF's efforts and will defer to the other services to analyze and describe their own undertakings.

4. Of course Desert Storm obviously had global implications, witness the global coalition of forces arrayed against Iraq. However, even though Iraq was a longtime Soviet and Russian client, the Russians did not orchestrate Saddam Hussein's actions or directly enter the conflict in his support.

5. For example, one of the first prisoners of war captured by the US Army during Operation Just Cause was a Panamanian West Point graduate.

6. *Joint Vision 2020,* June 2000, 6.

7. For definitions of these terms see *Joint Vision 2020.*

8. Joint Publication (JP) 3-0, *Doctrine for Joint Operations,* 1 February 1995, III-2. The publication correctly notes that the desired end state repre-

sents the set of conditions necessary to achieve strategic objectives and resolve a crisis.

9. Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940* (1955; reprint, Washington, D.C.: Office of Air Force History, 1992), 65–66.

10. Haywood Hansell, *The Air Plan that Defeated Hitler* (Atlanta: Higgins–MacArthur, 1972), 61–93.

11. Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 2, *Europe: Torch to Pointblank, August 1942 to December 1943* (1949; reprint, Washington, D.C.: Office of Air Force History, 1983), 357.

12. Ibid.; and Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, vol. 1, *Plans and Early Operations, January 1939 to August 1942* (1948; new imprint, Washington, D.C.: Office of Air Force History, 1983), 362.

13. Franklin D'Olier, chairman, *The United States Strategic Bombing Survey, Summary Report (European War)* (Washington, D.C.: Government Printing Office [GPO], 1945), 8.

14. John F. Kreis, ed., *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Washington, D.C.: Air Force History and Museums Program, 1996), 202–3.

15. For a discussion of these goals and how planners hoped to reach them, see Col Edward C. Mann III, *Thunder and Lightning: Desert Storm and the Airpower Debates* (Maxwell AFB, Ala.: Air University Press, 1995), 37, 41.

16. Ibid., 41.

17. Lt Col David A. Deptula, Washington, D.C., transcript of interview with Lt Col Suzanne B. Gehri, Lt Col Richard T. Reynolds, and Lt Col Edward C. Mann III, 12 December 1991, 96.

18. Although the planners were generally applying EBO thought processes, the idea that victory would most likely produce compliance may have been an artifact of the conquest paradigm.

19. Deptula, 96.

20. Just as the authors have elected to use spectrum of engagement rather than spectrum of conflict or any other term, they also have chosen the term *levels of employment* to refer to the term often called *levels of war,* that is, strategic, operational, and tactical. This terminology better fits the broad concepts of EBO as discussed here. Strategy, operations, and tactics apply to military actions in all phases of the spectrum of engagement.

21. Col David A. Deptula, *Firing for Effect: Change in the Nature of Warfare* (Arlington, Va.: Aerospace Education Foundation, 1995), 10.

22. Maj Steven M. Rinaldi, *Beyond the Industrial Web: Economic Synergies and Targeting Methodologies* (Maxwell AFB, Ala.: Air University Press, April 1995). Major Rinaldi develops the concept of an output (objective) based target process. Rinaldi's objective-based approach starts with the commander's intent and theater objectives then works through what (effects and) targets will contribute to the fulfillment of the selected objectives.

23. T. W. Beagle Jr., *Effects-Based Targeting: Another Empty Promise?* (Maxwell AFB, Ala.: Air University Press, December 2001), 8.

24. The term *airmen* refers here to members of the armed forces who are associated with the application of air and space power rather than the rank of a noncommissioned officer in the Air Force.

25. Maj Gen Timothy A. Kinnan, as commander of the Air Force Doctrine Center in 1999, explained the functional perspective in his briefing "Let's Get Serious about Working Together." He states that surface commanders have a geographic perspective wherein every commander below the joint force commander has an area of operations (AO). The Air Force contends that the joint force air component commander (JFACC), as well as other commanders, such as the joint force special operations component commander, must perform numerous functions (e.g., counterair, strategic attack, intelligence, surveillance, and reconnaissance) that cannot be relegated to any specific AO. Essentially, the JFACC has joint operating area or theaterwide responsibilities in order to best utilize the inherent flexibility of air and space power.

26. Amy Butler, "DOD Urged Not to Forget Benefits of Attrition, Annihilation Strategies," *Inside the Air Force*, 9 June 2000, 14.

27. Gen John P. Jumper explained his perspective regarding campaign-by-target-list management during his presentation on Operation Allied Force, Air War College, Maxwell AFB, Ala., 17 August 1999.

28. JP 3-60, *Joint Doctrine for Targeting*, 17 January 2002; and Air Force Doctrine Document 2-1.1, *Counterair Operations*, 26 April 2002. These documents address the impact of effects in military operations.

29. Maj Jay M. Kreighbaum, "Force Application Planning: A Systems-and-Effects-Based Approach," Class 7 (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, Ala., 1997–1998), 25.

30. Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, N.Y.: Cornell University Press, 1996), 56–57.

31. Briefing and paper, USAF Doctrine Center, Maxwell AFB, Ala., subject: Strategic and Indirect Effects: Defining and Modeling, 11 August 2000, 11–14.

32. Ibid. The physical, functional, systemic, and psychological nature of effects is discussed later in the paper, as are cumulative and cascading effects.

33. Beagle, 6.

34. Kreighbaum, 75.

35. Beagle, 6.

36. While effects may theoretically extend to the fourth order and beyond, this paper considers all effects beyond the second order under the rubric of third order effects.

37. Modified from JP 3-60, "Joint Doctrine for Targeting," 6 June 2000, preliminary coordination draft.

38. JP 3-60, final coordination draft, I-12, I-13.

39. Ibid., I-13. Fight-centric scenarios are, as the name implies, those operations involving combat on some scale. Conversely, mobility-centric operations are those normally associated with disaster response, noncombatant evacuation, or humanitarian aid.

40. Rinaldi. Rinaldi extensively covers the interrelatedness of national economic systems. Specifically, the interactions between sets must be part of the overall decision-making process if the global effects of air and space power are to be realized.

41. Beagle, 10.

42. Ibid., 11.

43. Ibid., 7.

44. Combat assessment (CA) is an overall evaluation of combat operations in relation to command objectives. This link of objectives with assessment is laudable, but as will be seen, remains primarily at the tactical level of war. CA consists of three subassessments: battle damage assessment (BDA), munitions effectiveness assessment (MEA), and mission assessment (MA). MA addresses the effectiveness of broad apportioned missions, such as interdiction, counterair, and so forth. MEA analyzes the effectiveness of munitions damage mechanisms, for example, fusing against specific target types. The USAF guidance further subdivides the often, overshadowing pillar, BDA, into assessments of physical damage, functional damage, and target system.

45. JP 3-60, preliminary coordination draft, GL-10.

46. Beagle, 7.

47. Ibid.

48. Air Force Manual (AFMAN) 1-1, vol. 1, *Basic Aerospace Doctrine of the United States Air Force,* March 1992, 12.

49. JP 3-0, *Doctrine for Joint Operations*, 1 February 1995, II-1.

50. Kreighbaum, 22–23.

51. Air Force Doctrine Document (AFDD) 2-1.2, "Strategic Attack," draft, 1 January 2000, 7.

52. AFDD 2-1, *Air Warfare,* 22 January 2000, 7.

53. Kreighbaum, 23.

54. Briefing, USAF Doctrine Center.

55. Deptula, *Firing for Effect,* 5.

56. Robert Jervis, *System Effects: Complexity in Political and Social Life* (Princeton, N.J.: Princeton University Press, 1997), 10.

57. JP 3-0, ix.

58. AFDD 2, *Organization and Employment* of *Aerospace Power,* 17 February 2000, 88.

59. Institute for Defense Analyses/Joint Advanced Warfighting Program, "New Perspectives on Effects-Based Operations," draft annotated briefing, 22 March 2001, 23, 26–27.

60. Credit is due to many people for the discussion of EBO methodology and the information conveyed in figures 2, 3, and 4. A great deal of time and effort were spent on developing the construct as presented here, so it is difficult to determine exactly what credit is due to whom. Certainly the EBO materials produced by the Institute for Defense Analyses/Joint Advanced Warfighting Program and at the Air Force Research Laboratory are progenitors of many of the ideas contained herein. The authors are indebted to those organizations.

61. David E. Thaler, "The Strategies-to-Tasks Framework," RAND briefing at the Air Force's Modernization Planning Conference, 23 March 1993. The figure also contains material extracted from the draft Concept of Operations for Effects-Based Operations version 2.0 (9 October 2001) by Dr. Maris McCrabb, 7.

62. Archer Jones, *The Art of War in the Western World* (New York: Oxford University Press, 1987), 413.

63. James M. McPherson, *Battle Cry of Freedom, The Civil War Era* (New York: Ballantine Books, 1989), 817–20.

64. Robert F. Futrell, *The United States Air Force in Korea, 1950–1953* (Washington, D.C.: Office of Air Force History, 1983), 190–201.

65. Al Santoli, *Perspectives*, online at http://www.thehistorynet.com/Vietnam/articles/02963_text.htm, 11 June 2001.

66. Dr. James Titus, "The Battle of Khafji, An Overview and Preliminary Analysis" (paper, College of Aerospace Doctrine, Research and Education, Maxwell AFB, Ala., September 1996).

67. Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, D.C.: GPO, April 1992), 200–201, 215.

68. Michael Howard, "Military Science in an Age of Peace," *RUSI Journal*, March 1974, 3–11.

69. Gen John A. Shaud, USAF, retired, Washington, D.C., interviewed by Gary Endersby and Edward C. Mann III, 15 June 2000; and Sam Gardiner, interviewed by Gary Endersby, Thomas R. Searle, and Edward C. Mann III, 20 April 2000, Maxwell AFB, Ala.

70. Discussions with various personnel who have participated in the games rendered this opinion.

71. As is usually the case when discussing processes, this is both descriptive and prescriptive. It describes a process, which the authors believe takes place either formally or informally, with or without our understanding it, and whether or not in this precise form (description). Formalizing our thinking about how this process should work aids in decision making and enables the achievement of desired outcomes (prescription) on a more frequent basis.

72. Use of the term *phase* may be slightly misleading here. These divisions of the process are necessary to describe the totality of the process, but they are sequential only in a very general sense. Many of them are occurring simultaneously during an operation, and the entire process is iterative based upon feedback received throughout the operations. For instance, as already stated, strategic environment research is a continuous process before, during, and after a given operation. Nonetheless, in order to describe a process it must be segmented in some manner, so the term *phase* is used here to differentiate the segments of the process.

73. Some readers are likely to try to equate this phase to the strategic estimate that theater combatant commanders (formerly referred to as CINCs) develop for their areas of responsibility. That effort would necessarily be part of, but only part of, strategic environment research, which would actually be a much wider concept encompassing the efforts of a large number of agencies, the joint staff, service staffs, intelligence organizations (military and national), and so on. It would also encompass study of a wider range of subject matter, like the very nature of human psychology and efforts to change people's minds, for one example. Greater detail is offered in later paragraphs.

74. EBO methodology will apply even in peacetime. Based on the national military strategy, peacetime engagement requires the United States to engage in multilateral training exercises, nation assistance, foreign military sales, and other activities designed to support broad national objectives. These activities should also be based upon creation of desired effects within the target audiences, and planning for them should follow the same general outline as operational planning in a crisis.

75. This is not meant to denigrate the effort of planners in those cases, who did the best they could with only limited information on the subjects. This makes the point precisely! This knowledge is needed in advance.

76. Richard Overy, *Why the Allies Won* (New York: W. W. Norton and Co., 1995), 132–33. Overy reports that industrial absenteeism in Japan rose to more than 50 percent by the end of the war.

77. AFMAN 1-1, 12.

78. Stephen T. Hosmer, *Psychological Effects of US Air Operations in Four Wars 1941–1991: Lessons for US Commanders* (Santa Monica, Calif.: RAND, Project Air Force, 1996), 181–86.

79. Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (1942; new imprint, Washington, D.C.: Office of Air Force History, 1983), 261, 293–394.

80. Craven and Cate, 2:370–76.

81. Deptula interview, 22–23 May 1991, 41–42.

82. Ibid., 11; Overy, 127–28; and Mann, *Thunder and Lightning,* 151.

83. In both cases used here for examples, the USAF tried very hard to make these studies scientific, both during and after the conflicts. In World War II distinguished scholars and industrialists were brought together to form the Committee of Operations Analysts who were to determine the strategic vulnerabilities of Germany and Japan. See Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force,* vol. 1, *1907–1960* (Maxwell AFB, Ala.: Air University Press, December 1989), 143. The problem was that, even though the distinguished scholars and industrialists contributed significantly to Army Air Forces (AAF) analytic ability, there was a paucity of real information available on the German systems in question. See Craven and Cate, 2:362. Also, while the committee recommended on 8 March 1943 that the AAF make a "continuing analysis of the successes and failures of air operations," the AAF did not act on their recommendation until the spring of 1944. See Futrell, 1:143. Thus, for most of the war, air operations success was determined primarily through poststrike photo analysis of individual strike missions (although Ultra intercepts provided much of the contextual information on the generalized effects of strikes. See Kreis, 76–78). After the war the United States Strategic Bombing Survey tried to scientifically determine the impact, but even though they had unparalleled access to damaged targets and German industrialists, their reports were mixed concerning results and have been interpreted in different ways by different analysts to prove almost anything you might want proved. Futrell, 2:144–47. In the case of Desert Storm, once again during the war scientific analysis of functional effects was made very difficult by the lack of intelligence collection of anything but photographs of physical damage, and by certain intelligence analysis methodologies that had developed during the Cold War (for instance, the insistence of some intelligence agencies on confirming mobile target kills with overhead photography—something that was almost never going to happen through our collection system). Some of the planners tried mightily, but they were pretty thoroughly hamstrung by these limitations. After the war the USAF commissioned the Gulf War Airpower Study to take a more scientific look, but they were severely constrained by availability of data. They could not go to the vast majority of targets in Iraq (which included virtually all the strategic targets), and data on the tactical and operational targets was severely limited due to the danger from clutter and unexploded ordnance on the battlefield. Once again they were able to do a pretty good job analyzing levels of physical destruc-

tion, but higher-level effects (functional, systemic, and psychological) often proved too hard to do. Deptula interview, 22–23 May 1991, 11.

84. Defense Intelligence Agency, *Battle Damage Assessment (BDA) Quick Guide, PC-8060-1-96* (Minneapolis: Department of Defense Intelligence, Naval Reserve Unit DIAHQ 0878, 1996), 5–7. The *Quick Guide* divides analysis into three categories: Physical-damage assessment, functional-damage assessment, and target-system assessment. However, all of these assessments are directly related to physical damage and it's accumulation over a system. There are no assessment criteria for effects other than physical damage.

85. These can be thought of as the national policy effects desired. At each level of planning (grand strategic, strategic, operational, and tactical) the desired effects will need to be defined before the strategy and tactics are planned at that level.

86. Note that the host-nation ambassador will play a significant role.

87. Efforts are ongoing to place control of ISR resources directly in the hands of employing commanders (JFACC's, JFC's). Soon there will be links from many ISR assets directly to the "shooters" in the field. This enhanced situational awareness, combined with improved communications capability will allow immediate replanning and retasking of operating forces. The planning-execution-assessment cycle in some cases may take only seconds and will require a very agile, continuous, iterative planning capability.

88. Beagle, 39.

89. General Shaud interview, 15 June 2000, authors' notes; and Gardiner interview, 20 April 2000, authors' notes.

90. Headquarters USAF, *Air War over Serbia*, 25 April 2000, ix, 38.

91. General Shaud interview, 15 June 2000, authors' notes; and Gardiner interview, authors' notes.

92. Amy Butler, "DOD Urged Not to Forget Benefits of Attrition, Annihilation Strategies," *Inside the Air Force*, 9 June 2000, 14, cited in *Early Bird*, 10 June 2000.

93. See, for instance, Mann, *Thunder and Lightning*, especially chap. 10.

Terms and Definitions

2d, 3d, nth order effects. a causes b causes c causes . . . For example, disruptions in the electric grid . . . yields rolling blackouts . . ., which disrupt petroleum deliveries to airfields . . ., which disrupt air operations. (Air Combat Command [ACC] Effects-Based Operations [EBO] white paper)

battle damage assessment. An estimate of the damage or degradation resulting from the application of military force, either lethal or nonlethal, against a target or system. This estimate should be timely and accurate and can be applied to the employment of all types of weapon systems (e.g., air, ground, naval, special forces, and information). Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment. Also called BDA. (Modified from Joint Publication [JP] 3-60, "Joint Doctrine for Targeting," 6 June 2000, preliminary coordination [PC] draft)

cascading effects. An indirect effect that ripples through an adversary system, often affecting other systems. Typically, a cascading effect flows from higher-to-lower levels of employment and is the result of influencing nodes that are critical to multiple adversary systems. (ACC EBO white paper)

causal linkage. Explanation for how a particular action contributes or leads to a given effect. It answers the question, "Why do planners believe this action will create or help create the desired effect?" (ACC EBO white paper)

collateral effects. Outcomes that result when something occurs other than what was intended. These outcomes may be either positive or negative to the original intent. In one sense, collateral effects may be the incidental direct or indirect effects (usually unintentional) that cause injury or damage to persons, objects, or systems. In a broader perspective collateral effects cover a wide array of possible downstream results. (ACC EBO white paper)

combat assessment. The determination of the overall effectiveness of force employment during military *actions*. Combat assessment is composed of three major components, (a) battle damage assessment (BDA), (b) munitions effects assessment (MEA), and (c) mission assessment (MA). Also called CA. (Modified from JP 3-60 PC draft)

cumulative effects. The aggregate result of many direct or indirect effects against an adversary. Typically, a cumulative effect flows from lower-to-higher levels of employment and occur at the higher levels; however, it may occur at the same level as a contributing lower-order effect. (ACC EBO white paper)

direct effects. Immediate, first-order effects (e.g., weapons employment results). They are the results of actions with no intervening effect or mechanism between act and outcome. (ACC EBO white paper)

effectiveness. The measurement of the results or outcomes of military actions. (Modified from JP 3-60 PC draft)

effects. A full range of outcomes, events, or consequences that result from a specific action. (ACC EBO white paper)

effects assessment. The evaluation of the overall effectiveness of *military actions* in terms of measures of merit in relation to stated objectives and policy goals. (Proposed definition)

effects-based. An action taken with the intent to produce a distinctive and desired effect. (ACC EBO white paper)

effects-based operations. Actions taken against enemy systems designed to achieve specific effects that contribute directly to desired military and political outcomes. (ACC EBO white paper)

effects-based operations methodology. A methodology for planning, executing, and assessing operations designed to attain the effects required to achieve desired national security outcomes. (ACC EBO white paper)

effects-based strategy. The coherent application of national and alliance elements of power through effects-based processes to accomplish strategic objectives. Also called EBS. (Proposed definition)

functional assessment. The estimate of the impact of military force to degrade/destroy or otherwise affects the functional or operational capability of a target or system to perform its intended mission. Functional assessment includes the level of success of the force applied relative to the operational objective established. (Proposed definition)

functional effects. Direct or indirect effects of an attack or operation on the ability of a target to function properly. In essence, it answers the question, to what extent has the function of the target been degraded or affected by those actions. (ACC EBO white paper)

indirect effects. Those effects, which are created through an intermediate effect or mechanism, producing a final outcome or result. They are 2d, 3d, and nth order effects, which may be functional, systemic, or psychological in nature. Indirect effects tend to be delayed and typically are more difficult to recognize than direct effects. (ACC EBO white paper)

measures of effectiveness. The indicators required to determine whether or not individual component missions, joint campaign phases, and/or a theater campaign in general are meeting stated objectives. Assessment of such indicators normally takes place at the tactical-, operational-, and even strategic-levels of war. The key is to determine when the predetermined conditions have been met that affect enemy operational employment or overall strategy. Also called MOE. (Modified from JP 3-60, PC draft)

munitions effects assessment. An assessment conducted concurrently and interactively with battle damage assessment. This assessment applies to the weapon system and munitions effectiveness to determine and recommend any required changes to the methodology, tactics, weapon system, munitions, fusing, and/or weapon delivery parameters to increase force effectiveness. Also called MEA. (Modified from JP 3-60, PC draft)

operational effect. The link between tactical results and strategy; typically, the cumulative outcome of missions, engagements, and battles. An operational effect also may

result from the disruption of systems or areas of operational value. (ACC EBO white paper)

operational effects assessment. The measurement of effects at the theater level. Operational assessment determines whether or not military action is properly supporting overall strategy by meeting operational objectives. (Modified from JP 3-60, PC draft)

physical damage assessment. The estimate of the quantitative extent of physical damage through munitions blast, fragmentation, and/or fire damage effects to a target resulting from the application of military force. This assessment is based upon observed or interpreted damage. (JP 3-60, PC draft)

physical effects. Effects created by the direct impact through physical alteration on the object or system targeted by the application of military action. (ACC EBO white paper)

psychological effects. The results of actions that influence emotions, motives, objective reasoning, and ultimately the behavior of foreign governments, organizations, groups, and individuals. (ACC EBO white paper)

strategic effect. Disruption of the enemy's overall strategy, ability, or will to wage war or carry out aggressive activity. (ACC EBO white paper)

strategic effects assessment. Strategic effects assessment represents the measurement of effects at the strategic level of *employment*. Strategic effects assessment determines whether or not overall strategy is working and if the strategic objectives are being achieved. (Modified from JP 3-60, PC draft)

synergistic effects. The proper application of a coordinated force, which can produce effects that exceed the contributions of the individual forces employed separately. The precise, coordinated application of the various elements of air, space, and surface forces brings disproportionate pressure on adversaries to comply with our national will. US military power is able to accomplish synergistic effects and thus dictate the tempo and direction of an entire warfighting effort from military operations other than war

through major conflict. (Modified from Air Force Doctrine Document 1, *Air Force Basic Doctrine,* September 1997)

systemic effects. Effects on the operation of a specific system or systems. In essence, it answers the question to what degree has the system or systems been degraded or affected by those actions directed against it. (ACC EBO white paper)

tactical effects. Effects, which are the result of action(s) at the individual unit, mission, or engagement level. Tactical effects influence activities at the tactical level of *employment* and focus on battles and/or engagements to accomplish military objectives. These effects can be either direct or indirect, and typically are acts in concert with other tactical effects to produce results at higher levels of *employment.* Examples include individual aircraft and tank attrition, airbase denial, suppression of enemy fire, and so forth. (Modified from AFDD 2-1, *Air Warfare,* 22 January 2000 and JP 3-60, PC draft)

unintended effects. Unanticipated effect that could impact the campaign or have overall negative consequences. The destruction of the adversary's electric grid affects the command and control of his military operations but also disrupts power to water treatment plants, which leads to increased levels of disease. (ACC EBO white paper)

Thinking Effects

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